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# A STUDY OF THE EFFECTIVENESS OF SYMPOSIA FOR TRANSFERRING TECHNICAL INFORMATION TO APPLIED END USE

NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

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# NAVAL POSTGRADUATE SCHOOL
## Monterey, California

# THESIS

A STUDY OF THE EFFECTIVENESS OF SYMPOSIA
FOR TRANSFERRING
TECHNICAL INFORMATION TO APPLIED END USE

by

Donald R. Bennett
John L. Sweeney
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September 1976

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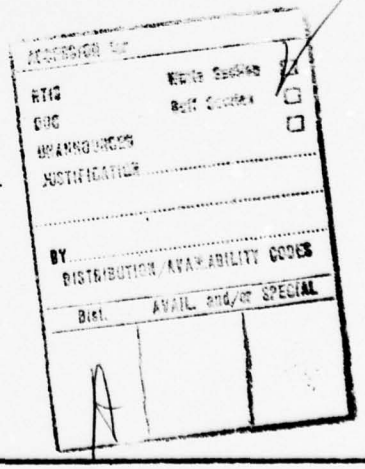

# A Study of the Effectiveness of Symposia for Transferring Technical Information to Applied End Use

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## ABSTRACT

A program is designed for the transfer of technology from the Navy's research effort to other potential users. This program uses the technical symposium as the basic mechanism for transfer, drawing on the technological resources of research organizations and the perceived needs of the user community. It is designed to communicate technological information, to develop a mutual appreciation of each others problems and to establish communications among all participants in the technology utilization process.

A plan is developed for a technology transfer symposium in the field of Communications Electronics based on promising research efforts in this field performed at the Naval Postgraduate School (NPS). This symposium is proposed as the prototype vehicle for the Navy's Technology Transfer Symposium Program.

Lastly, a technique is developed for measuring the effectiveness of the symposium program, utilizing feedback from preceding symposia, so that the format of similar future programs might be optimized.

## EXECUTIVE SUMMARY

The Navy requested two-hundred million dollars for Research, Development, Test and Evaluation (RDT&E) for fiscal year 1977. The results from this investment will be a significant output of potentially usable technology. Because of numerous transfer barriers, however, there exists a high probability that the total worth of this valuable national resource will not be realized within a reasonable time span, if indeed, at all.

The major objective of this study is to design a Navy Technology Transfer Symposium Program which will provide a means of transmitting the technology products resulting from research investments to the entire Naval establishment, to the rest of the Department of Defense (DOD), to other Government technology users and to the Private sector. If the technology developed with these funds is utilized to the fullest extent, this effort has the possibility of adding to the United States Gross National Product (GNP) more than ten times this RDT&E investment. (Gibson, 1975, p.4)

One of the perceived primary barriers to effective technology transfer is the lack of an appreciation by the individual members of the technology utilization chain (researchers, developers, producers, users) for the capabilities, limitations, objectives, and needs of the other members. This is considered to be due in large part to the lack of a free-flow communications channel among these activities. A primary goal of the Technology Transfer Symposium Program is not only to transfer technological facts, but to foster mutual understanding among the participants, and to develop contacts and communications between the various individuals and organizations involved in the process. The symposium is designed to

accomplish this by utilizing several mechanisms to deeply involve members of the chain in a symposium atmosphere of mutual help. The participants' knowledge, awareness, effectiveness, attitudes, behavior and values should all be enhanced through the symposium experience.

The Technology Transfer Symposium Program would consist of an on-going series of technology related symposia sponsored by the Chief of Naval Material (CNM) bringing together the producers of the Navy's research, the producers of the products that result from this research, and the ultimate users of the products. Included, in addition to Naval activities, are organizations from other services, other governmental agencies, and private industry. A unique feature of this symposium program would be the integration of the user into the presentation portion of the format, bringing to the other participants a knowledge of the users' needs, limitations and perceptions.

To initiate this program, a plan is developed for a prototype symposium. This symposium is developed around the subject of Communications Electronics, and is based on a compilation of particularly promising research efforts performed in this field at the NPS.

To provide a direct feedback of the strengths and weaknesses of the proposed symposium program, an effectiveness evaluation system is devised to be used in conjunction with the symposium. This evaluation program is integrated into the symposium structure, utilizing various inputs from the participants, assembled so as to involve the participant in the symposium environment. The effectiveness measures look at two aspects of the symposium: (1) How it may be improved; and (2) How effectively it may achieve the goal which is sought; namely, a fostering of technology transfer, which in turn leads to more effective use of technology.

The program is designed to be initiated by the Chief of Naval Operations in recognition of the importance of the technology transfer effort. CNM is designated program manager and is envisioned as utilizing NPS as a source of expertise in the discipline of technology transfer.

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## LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| CEL | Civil Engineering Laboratory |
| CNM | Chief of Naval Material |
| CNO | Chief of Naval Operations |
| DDR&E | Director Defense Research and Engineering |
| DOD | Department of Defense |
| DOT | Department of Transportation |
| EPA | Environmental Protection Agency |
| ERDA | Energy Research and Development Agency |
| FCA | Federal Communications Agency |
| GNP | Gross National Product |
| JPL | Jet Propulsion Laboratory |
| MIT | Massachusetts Institute of Technology |
| NADC | Naval Air Development Center |
| NARF | Naval Air Rework Facility |
| NASA | National Aeronautics and Space Administration |
| NAVAIRPAC | Naval Air Pacific |
| NAVAIRSYSCOM | Naval Air Systems Command |
| NAVCOMSTA | Naval Communications Station |
| NAVELEXSYSCOM | Naval Electronics Systems Command |
| NELC | Naval Electronics Laboratory Center |
| NMC | Naval Material Command |
| NPS | Naval Postgraduate School |
| NRL | Naval Research Laboratory |
| NTIS | National Technical Information Service |

| | |
|---|---|
| R&D | Research and Development |
| RDT&E | Research Development Test and Evaluation |
| SYSCOMS | System Commands |
| TAFI | Technology Applied to the Food Industry |

# I. INTRODUCTION

## A. OVERVIEW

Few human undertakings in the modern world are as important as the development and application of technology, and yet few subjects are so little understood. When one thinks of technology, one usually thinks of industrial machines or instruments of war. It should be emphasized that technology, or the practical utilization of science, is widely applied outside those two spheres.

Technology is now a currency of foreign affairs. It is a tool of advanced nations and a hope for underdeveloped ones.

Unfortunately, the abilities of research to unlock more and more of the secrets of nature appear to have outstripped the capacities of other engineers and scientists to apply and utilize this new found knowledge to alleviate the ills of a rapidly growing world.

The concept of technology transfer is difficult to grasp since its meaning seems to vary as a function of the audience discussing it. In general however, the transfer of technology differs from the usual dissemination of scientific knowledge in that it is more concerned with the usage of technological information obtained through research/development than its mere exposure to fellow scientists and academicans (Hendrickson and Fisher, 1974, p. 12). Thus, mechanisms developed for transferring technology from its origins to points of use need to be directed toward methods and areas of application, rather than just toward the publication of scientific results in technical documents.

It is important to recognize that technology transfer, in effect, takes place when a new use is found for existing information. It is not important

whether the idea is new, only that it is new to the person adopting it. (Jolly, 1975, p.149)

The role of the Navy in the technology transfer process involves both the transfer of technology developed in Navy laboratories, and the utilization of technology developed by other laboratories. The Navy budget, however, allocates little funding for the establishment of a technology transfer medium. It is necessary, therefore, that whatever medium is chosen must provide the maximum effectiveness at the lowest cost. It is considered that a symposium atmosphere would provide a means for bringing users, producers, and innovators together in a common environment; giving each the opportunity to become aware of the goals, requirements, motivations, capabilities, and problems associated with each others' roles in technology utilization.

## B. OBJECTIVES OF THE STUDY

The objective of this study is to design an effective Technology transfer Mechanism that can be implemented by the Chief of Naval Material (CNM) to permit the timely and orderly transfer of applicable technology now a part of, or that in the future will enter, the Navy inventory to all other sectors of the national economy, military, non-military, public and private.

A secondary objective is to promote mutual understanding and communication among the members of the technology utilization chain. Specifically the mechanism under study is the symposium which, while certainly not a new medium for this purpose, has not in the past been subject to a searching analysis of its effectiveness for the purpose intended.

## II. A STUDY OF THE TECHNOLOGY TRANSFER REQUIREMENTS OF THE NAVY

### A. THE LACK OF UNINHIBITED "FULL FLOW" COMMUNICATIONS

The thrust of the "National Policy and Priorities for Science and Technology Act of 1976", is that science and technology can aid in solving many critical national problems and provide an improved quality of life for the peoples of the world. Only in a sense is this true. Technology must be used if it is to provide any practical benefit. An undeveloped idea has little effect. The utilization of technology is based primarily on the establishment of communication between the creators of technology and its developers and users. The thrust of technological process must be such that it fulfills the needs of both the user and society. Communication requires that the capabilities of technologists be understood by the developers and users, and that the needs of the users be understood by the technologists. In the broadest sense, technology transfer is this communication of ideas, needs, capabilities, and knowledge between the technology producers and consumers. A restricted definition of technology transfer involves the utilization of technology for a purpose other than that for which it was originally created. (Gruber and Marquis, 1969, p. 255,6) Again, the primary requirement is that of establishing communications. The technologist must know the user's needs and he must perceive that, through adaptive design, existing technology can provide a means of filling these needs. Similarly, the user not only must be aware of his own needs, but he must also perceive that technology can provide a means of fulfilling some of these needs. He also must be aware of which existing technology can be adapted to these needs. While the need to

make the maximum use of that technology which we have developed already is widely recognized, an effective means of opening this communications link has not yet been established. One might think that technological innovators and those desiring to gain the benefits of technology would be pounding on one another's doors. In fact however, there are several problem areas which restrict this desire to interact.

One of the biggest impediments to communicate is the communication process itself. Unfortunately, ideas cannot float from one person's mind into another's. Rather they must be translated into communicable symbols, transmitted, received and retranslated into thoughts. Because of the different environments in which producers and the consumers of technology operate, they are not attuned to each other and the impedance to transmission is high. Distortions in encoding and decoding exist because of differences in the generic vocabularies of the various groups. The orthopedist talks of a fractured tibia which is incomprehensible to the man with the broken leg. The British refer to an automobile "hood" as a "bonnet", a word which most Americans associate with ladies' hats. With "full flow" communications, this problem can be overcome, but as communication becomes formalized or restricted, the noise level can easily blank the signal.

A second restriction to the free flow of technology is that, despite a large amount of existing technology and ubiquitous social problems, solutions and problems do not often match exactly. Most technology must be tailored to the individual problem. The fact that adaptive development is normally required in technology transfer often obscures the fact that a small amount of investment can provide tremendous payoffs. The user can overcome the feeling that the technology producer is just trying to

increase his research budget only if he is familar with the whole evolutionary process of technology transfer. In turn, the producer must be aware of the practical aspects of adaptive engineering requirements and not expect that the mere transmission of an idea to a potential user ensures an instant solution to the problem which besets the user. The continuance of the evolution from research output into functional use requires an understanding of the whole process by each constituent in the process. This involves each person understanding the viewpoints, functions, problems, and motivations of each of the other players involved in moving technology from an idea to an end product. Often the researcher has a specific goal when he undertakes his efforts. Equally as often he may not, and is following a trail that unfolds before him. The designation of this goal may have been set for him, or it may be of his own creation, based on a perceived need. In either case, the more completely the researcher understands the real need which he hopes to fill with his technology, the more effectively he can direct his efforts in the efficient pursuit of that goal. Therefore, it should be incumbent on any researcher to spend some time in the user's shoes. This is not easily (or often) accomplished. As a result, much of the researcher's effort is directed to a goal that is perceived through his distorted view of the world. The user or consumer is similarly myopic. In the view of many laymen, the practioners of science and technology are omniscient and, by virtue of this, omnipotent. With this attitude, it is assumed that technology will not only chart the way past any shoals in the path, but will even define the destination for which one has embarked. Another, and equally inaccurate, view is that the technologist has his head in the sand chasing foggy notions and theories through space far from, and with no

feeling for the practicalities of the existing society which surround his ivory tower.

A third communication problem exists in the interface between communicators, or the linking mechanism.

Those people who possess unique characteristics such that they are motivated to advance the flow of knowledge are identified as linkers. (Havelock, 1967, p. 7-4A) Studies have shown, however, that less than 5% of the professional workforce can be classified as true linkers. (Jolly, Creighton, 1976, and Classen, 1973) This small quantity of available linker people further impedes communication.

The underlying cause of this state of affairs is a lack of communications and understanding between participants in developmental technology and their ultimate customers.

Technologies to solve many of the problems which confront us exist right now in the inventory of someone's ideas. How can these needs be communicated to the innovator, how can the ideas which are available be communicated to the developer? The need is to communicate not only the technology, but the idea that technology is available, and further, that technology can provide solutions to society's problems. Bloomenthal states in his treatise on "Promoting Your Cause" (Bloomenthal, 1975, p.6):

> "You can advance any purpose if you can bring people to do what needs to be done. The key is the word "bring"-- you must bring people over to the response you are looking for. The problem is not getting your idea over to them; it is getting them over to your idea....The distinction has practical, meaningful usefulness. For people to respond the way that you want, you must direct them from wherever they are mentally to your objective."

## B. THE SYMPOSIUM AS A MEANS TO DEVELOP COMMUNICATIONS

As stated previously, the objective of this paper is to design an

effective technology transfer program for implementation within the Naval Material Command (NMC). Analysis of the literature available on the subject of technology transfer and of the technology transfer programs of other agencies has led to the identification of the basic problem formulated in Section A above, i.e., that a primary impediment to the transfer of technology is the lack of a full and open communications channel among the various sectors of the technology utilization process. The objective then, evolves into the design of a system to improve the communication of technology with the NMC community and between the Navy and outside agencies in the technology utilization process. It is believed that this can be accomplished effectively through a continuing series of symposia related to individual topical areas of technology involving the creators of technology, the developers of technology, and the end users of technology. The succeeding portions of this thesis will be involved in the design of an effective technology transfer symposium program for the CNM. The unique feature of this design, compared with the methodologies of other symposium programs in the technology transfer process, will be the effort to integrate Innovators, Developers, and Users into the presentation and review portions of the program. This is in contrast to the usual format which provides for the unilateral transmission of information from one sector to the other, i.e., the technologist presenting the results of research to the potential users with a "use it if you like" connotation.

Investigations into the most recent methods of technology transfer reveal that the symposium is increasing in popularity as an effective means for knowledge dissemination. Every organization, private enterprise as well as governmental, seriously concerned with technology, is involved

in some aspect of symposium methodology. This is not surprising when one considers the symposium attributes.

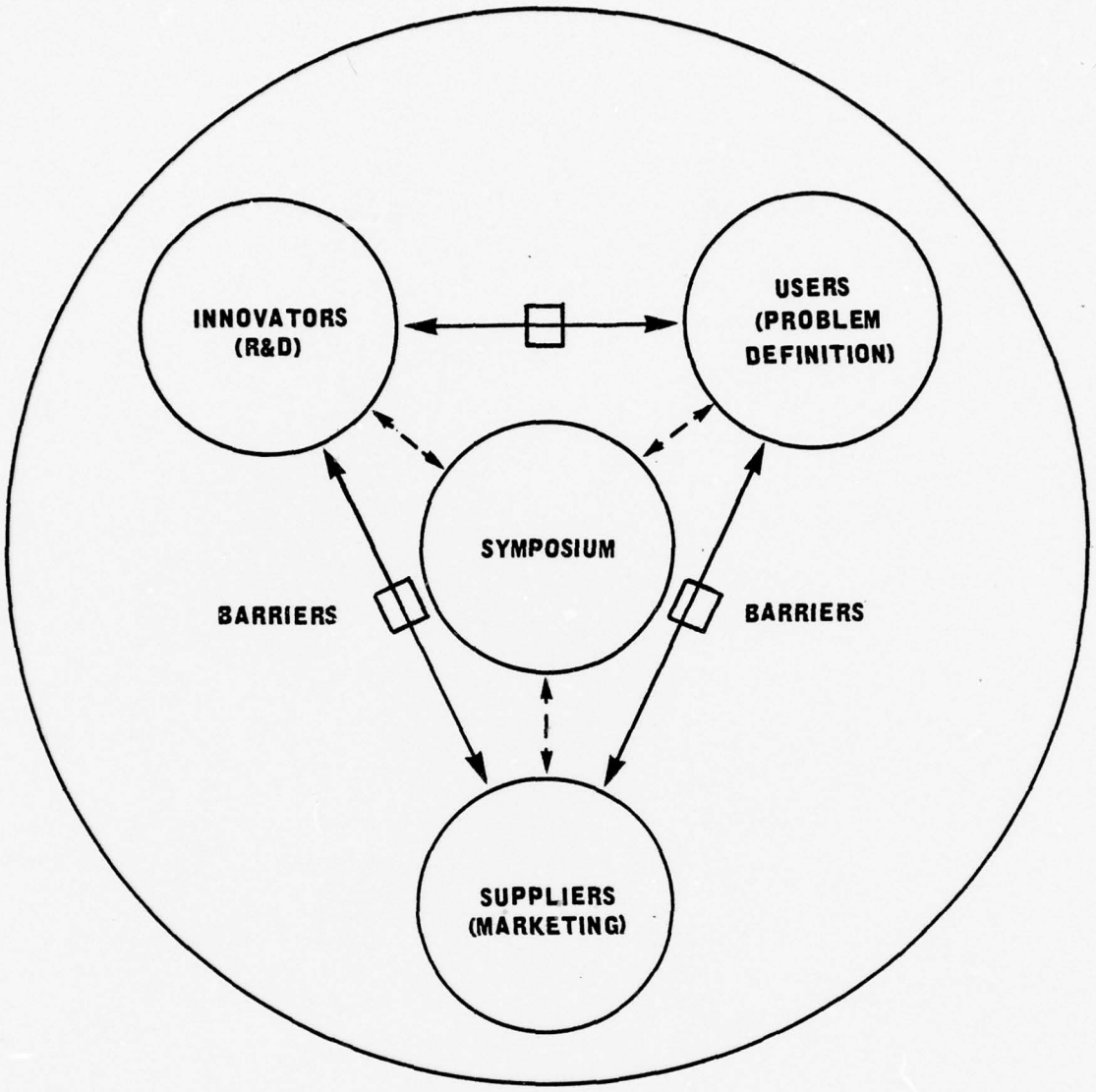
The symposium should accomplish the integration of a three-sided model: Problem definition, Product development including R&D, and Marketing. In this environment, demand pull and technology push can be brought together early. This concept is shown in Figure II-1.

The technology transfer symposium is helping to fulfill the increasing demands for linker types by assuming some of the duties normally performed by individual linkers. Linkers who are able to direct some time and attention to planning and organizing symposia are realizing greater rewards than those available to other linkers who use only the more common one-to-one approach. (See Appendix A for information on linker concept)

The symposium does not perform analysis for the user, nor does it attempt to evaluate the supplier's information to determine its applicability to the potential user. It does serve to bring the participants together so that direct communication may be established among principals who have compatible and complementary needs. Thus the symposium can magnify the normal linker role of bringing the "right" people together on a one-to-one basis.

## C. A PROPOSED CNM PROGRAM

The end result of this study is a proposal for a continuing symposium program to be sponsored by the CNM. This proposal is based on the background research performed on the status of technology in the United States and the status of technology transfer programs in being today. A part of this research included a two-week experience tour by two of the authors,




THE SYMPOSIUM INTEGRATES A THREE SIDED MODEL; PROBLEM DEFINITION, RESEARCH AND DEVELOPMENT AND MARKETING

FIGURE II-I

MODEL OF TECHNOLOGY TRANSFER SYMPOSIUM

one with the Chairman of the Senate Science and Technology Committee, and the other with the ranking minority member of the equivalent House Committee. One of the authors also attended the first International Technology Transfer Society Symposium, obtaining data on both the Federal technology transfer program and the symposium approach.

Of primary importance to any program is high-level support. In this program sponsorship should be established at the highest levels of the Navy to reflect properly the importance of technology utilization and technology transfer to the Navy. The NMC, as the lead organization within the Navy for the effective utilization of technology in producing products to meet the Navy's needs, is considered the most appropriate place to vest responsibility for the program's direction. The Naval Postgraduate School (NPS), because of its lead role in establishing the discipline of technology transfer as an independent skill, and because of the extensive research that has been performed in the areas of technology utilization and transfer by its faculty and students, is considered as the agent best qualified to act for CNM in launching and developing the program's earliest stages. The full depth of the evaluation program could be developed in the first several symposia under NPS guidance by establishing an optimized format and a streamlined evaluation technique. After the program has matured and the directions are firmly established, NPS should be placed in a participant role as a major producer of Navy research effort, and the program production function returned to CNM, either to be administered from there or to be rotated among other CNM activities such as laboratories, Naval Air Rework Facilities (NARF's), and Systems Commands (SYSCOMS).

The scheduled symposium program would bring together the many participants in the technical community within specific topical areas of

interest (i.e., Communications Electronics, Nuclear Propulsion, Hydrofoil Design, etc.). NPS would choose the topical areas for the first several symposia, working in conjunction with the various Navy labs, and would be responsible for the actual mechanics of running these symposia. Funding support would be provided by CNM. A work package describing the estimated funding and manpower requirements for initiating the program is enclosed as Appendix F.

Participants should be invited from other service labs, private industry, and user groups. The goals of this program would be to:

a. Disseminate information on new techniques and technologies developed in the Navy labs and in NPS.

b. Encourage the development of communications channels between technology developers and technology users.

c. Provide an awareness of the need for technology transfer, and in particular, the need for an understanding of the developer/user role.

d. Develop an environment for and promote the enhancement of professional competence in the general fields of technology assessment, transfer, utilization, and forecasting.

e. Provide an awareness of NPS' role and unique capability to provide research efforts in the form of thesis investigations which benefit from academic excellence blended with practical experience with the using environment.

f. Provide a focal point for technology transfer efforts within the Navy.

In the ongoing chapters, each of the following areas is covered:

a. Identification of the symposium as an effective technology transfer medium. (Chapter III)

b. Format of a trial symposium to demonstrate the effectiveness of this mode of technology transfer. (Chapter III)

c. Design of an effectiveness measurement system. (Chapter IV)

Drafts of the proposed implementing instructions for Chief of Naval Operations CNO and CNM are contained as Appendix D.

## D. DESIGN OF A MODEL SYMPOSIUM

Included in the design of this symposium program is a proposal for an initial effort to demonstrate the effectiveness of the symposium concept and to evaluate the symposium format as a tool for maximizing the attainment of the overall goals of the program. This initial symposium effort is aimed at the technical area of communications/electronics. The development of the proposal is based on the availability of a series of promising thesis research projects performed at the NPS in the field of communications electronics. This list was submitted to Director Defense Research and Engineering (DDR&E), the Naval Research Laboratory (NRL), CNM, and Navy Electronics Systems Command (NAVELEXSYSCOM) for review of the specific thesis topic areas, with DDR&E adding additional areas of interest. The basic format (and the whole project itself) was reviewed through a series of personal and telephone interviews with research organizations such as Naval Electronics Laboratory Center (NELC) and NPS, developing and product producing organizations such as the Texas Instruments Company and NAVELEXSYSCOM, using organizations such as Commander, Naval Air, Pacific, (NAVAIRPAC) the Naval Communications Station, Stockton, CA. and other government agencies; Department of Commerce, National Technical Information Service (NTIS), Environmental Protection Agency (EPA), etc.

## E. EFFECTIVENESS MEASUREMENT

A review of existing symposium programs did not uncover any comprehensive means for determining the effectiveness of the symposium effort. However an effectiveness measurement system is considered to be an absolute requirement of this program. To determine the extent to which the basic goals of the symposia are being accomplished and to determine the effects of future symposia format modifications that are being made to optimize future symposia, a system of effectiveness evaluation was devised. This system utilizes a multi-variate indicator system with data obtained through a series of sensing devices.

## III. THE SYMPOSIUM

### A. ROLE OF THE SYMPOSIUM

The symposium is a formal gathering organized for the discussion and free exchange of ideas on a particular subject. There is generally an abundant flow of formal dialogue by specialists presenting addresses on related topics, as well as a generous amount of informal conversation at social gatherings, during cocktail hours and throughout mealtimes. Symposia vary in attendance size from twenty-five to several hundred attendees and in length from a few hours to several weeks. Synonymous titles frequently used are seminars, workshops, conventions, conferences, forums, and trade-exhibits.

Since the 1940's, group meetings have expanded in number and complexity; today they are an integral part of many persons' and, especially professionals' lives. The concept of the world growing smaller is a twentieth-century phenomenon which we take for granted. Modern man has come to realize how closely we all are related to each other and how much our daily living involves the exchange of ideas with others through the discussion process. This is the age of communication. There is no substitute for the discussion process in bringing about our objective of understanding through communication. Literally, our government takes on more and more of the characteristics of true democracy as the participation of all of us increases through the discussion process. Resolving most of the barriers to communications is a matter of speaking and listening as much as possible with the other person's position and interest in mind.

Communication in business and industry has become one of the paramount

concerns of those responsible for the effective management of business organizations. Recent studies and surveys by the National Association of Manufacturers, the American Management Association, and the National Industrial Conference Board point up the need for and current practices in communication throughout an organization. These and others have found that one of the chief, if not the basic, medium for accomplishing the communication objectives of a business organization is the conference. The probable reason for this popularity is because it enhances "one to one" communications which in turn is recognized as one of the most effective ways of exchanging technical information. (Creighton 1975, p. 95) The total discussion process ideally is a cooperative effort on the part of a number of individuals to work together as a group, through the exchange of thought, toward some common objective. Conferences accomplish at least these major objectives:

1. To keep people informed
2. To solve problems and draw on the resources of the group
3. To train and instruct
4. To provide a participation medium for the individual
5. To provide opportunity for person to person idea interchange

(Zelko, 1975, p. 5 - 14)

The symposium concept as envisioned in this paper is consistent with Warren H. Schmidt's description of a fact-finding conference:

> "The distinguishing characteristic of the fact-finding conference is that its primary objective is to get information from the participants and opinions which will form the basis for future planning and action. In this type of meeting, the participants are chosen because of their resources. Although action is often a by-product of the fact-finding conference, the objectives of the meeting are attained even if the group does not arrive at agreement or commitment to action".

Ten features of the fact-finding conference are discussed by W. H. Schmidt. They are listed below:

The fact-finding conference:

1. Can bring together people who would not come together otherwise
2. Provides a comfortable setting in which to express ideas and attitudes
3. Helps to clear up misunderstandings
4. Establishes many new informal channels of communication among participants
5. Produces more information and insights than are possible through other survey methods
6. Stimulates follow-up action growing out of real needs
7. Paves the way for co-operative action
8. Enables participants to understand more fully the objectives, boundaries, and problems of other organizations
9. Is rewarding to the individual participant
10. Produces an unusually good setting for creative thinking

(Schmidt, 1970, p. 111 - 116)

B. REQUIREMENTS OF AN EFFECTIVE SYMPOSIUM

The success of the symposium lies in: (1) the amount of effort applied in planning and scheduling the facilities, participants, agenda, and attendees, (2) the extent to which the attendees participate and become personally involved, and (3) the degree of emphasis given to obtaining and using feedback, evaluation and effective measurements of the entire program. The literature provides good basic advice on how to achieve these success "yard-sticks", but there is no substitute for the experience gained through personal involvement.

1. Planning

Most authorities give wide coverage to the planning phase of the group meeting and generally agree it is the most important. If sufficient consideration is given to the planning, the other success goals will fall into position. The major problem, however, is determining what should be planned. It is recommended strongly that a planning "Plan" be developed and followed to ensure that all areas are considered. A symposium planning "Plan" provides the host agency with a detailed planning strategy, a list of what to plan and the methods to be used, including contingencies. This is especially helpful when a planning committee is used and various members are delegated to cover portions of the planning tasks.

Harold P. Zelko syas: "There is little excuse for failing to plan and prepare for a conference by following a series of systematic steps:

a. Determine the purpose of the meeting
b. Consider the participants, special guests, or speakers
c. Analyze the entire group
d. Prepare a conference agenda
e. Send notices to all who will attend
f. Arrange facilities
g. Assemble necessary materials
h. Prepare an outline for leading the discussion
i. Prepare for participation
j. Plan for making a report of the results (Zelko, 1957, p. 61)

Gordon L. Lippitt (Lippitt, 1970, p. 3) suggests there are multiple roles the meeting planner must perform personally or, in the case of a large meeting, delegate to assistants. Lippitt's four major roles are:

(1) As Presentation Specialist

(2) As a Planner

(3) As an Information Coordinator

(4) As a Consultant to Management

Mr. Lippitt sees the consultant to management role as the most important and developed the model shown in Figure III-1 to show its relationship to management. (Lippitt, 1970, p. 3)

Beckhard provides six basic principles he feels the meeting planner must consider if the meeting is to satisfy both the planners and the audience:

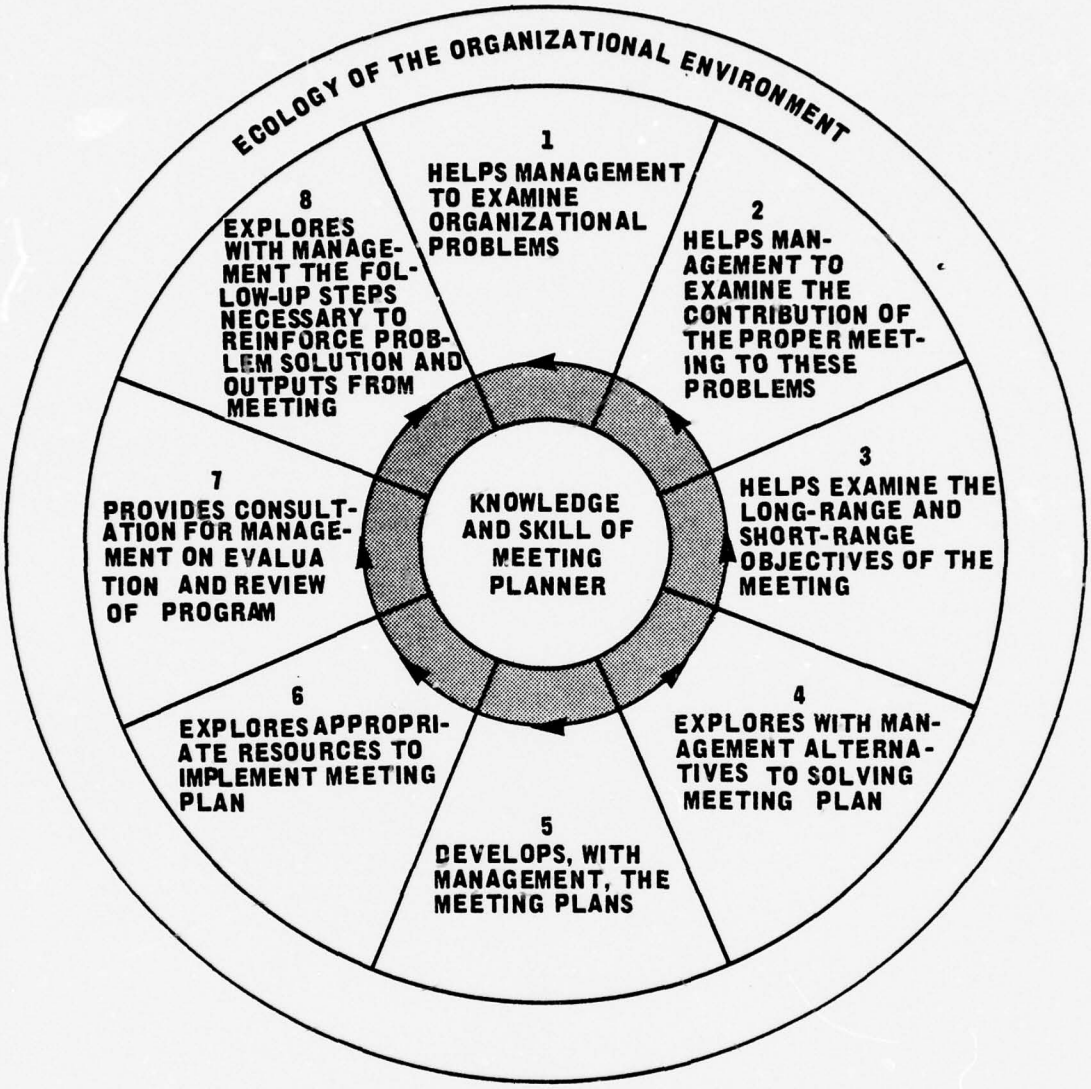
(1) The planners must have a clearly defined objective for the total meeting and for each session. These objectives must be realistic and attainable.

(2) The planners should know their audiences' interests and what audience members expect to receive from the meeting. These interests and expectations must be related to the objectives.

(3) Planners should insure that audience members feel that the meeting is concerned with their problems and is of importance to them. Audience members should participate in the planning wherever possible.

(4) Presentation methods for each item of subject matter should be devised in terms of both the material to be presented and the situation in which it will be presented.

(5) Planners should test the effectiveness of the communications at the meeting and again after the meeting in order to improve subsequent meetings.




**THE CHALLENGE FOR THE MEETING PLANNER IS TO DEVELOP HIS SKILLS AND ROLES IN THE ORGANIZATION AS AN INTERNAL ORGANIZATIONAL CONSULTANT ON PROBLEM SOLVING, CHANGE AND ORGANIZATIONAL DEVELOPMENT**

**FIGURE III-I**

**LIPPIT'S PROBLEM SOLVING MODEL OF THE MEETING PLANNER**

(6) Systematic follow-up procedures should be devised as part of the planning in order to assure adequate "take-home pay" for the attendees. (Beckhard, 1970, p. 132)

2. Participation

Early literature paid less attention to participation in symposia than to leadership, yet the average person has many more experiences and responsibilities in the participant's role. There is now a growing body of knowledge about the specific techniques one can employ to improve symposia. The most recent literature gives much attention to the involvement of the attendees and the problems of group behavior. Benne and Demorest provided an interesting concept of the participant in a symposium or conference. They state:

> "The person who attends a conference is both an emigrant and an immigrant. He emigrates for the time from the familiar continent of his work setting, his everyday organizational involvements, his home, his neighborhood. He immigrates into an island culture deliverately set up with certain aims and objectives in mind. He comes under the influence, at least potentially, of people who are different from those with whom he ordinarily associates. He enters into relationships with people whose back-home reality differs from his own. He lives in a set of social arrangements, by a set of standards and mores which are different, at least in some respects, from those with which he is accustomed. He travels into a new culture which is designed to make him different at the end from the way he was when he came."
>
> "When we stop to think of it, this travel into a new culture is essential in providing opportunities for change and growth for the people attending the conference. But it does raise problems for the participant about how he is to handle the differences between conference reality and the home reality. The society of the conference needs to be different enough to challenge the customary ways and beliefs of the participants. However, it must not be so out of this world that the participants can build no bridges in thought and action between what takes place in the conference and what goes on back home."

"Just as being a member of two societies presents important problems of adjustment for the conference participant, so does it present a problem for those who assume the responsibility of setting up the conference. How can they help to build the kind of conference community which supports each participant in solving constructively his problems of dual membership?"

"One thing is certain. Unless the immigrants become genuine members of the conference society - participants in its life, its play, its work - the experience will have little, if any, lasting effect on them. There must be built into the conference a community in which immigrants can have and feel membership. Otherwise they remain tourists in a conference culture. They may take home interesting gadgets from a far off land....They may take home wise sayings from the head men of the tribe who spoke to them there on ceremonial occasions. They may take back tales to regale the home folks between jobs, when nothing important needs to be done. But they will take back no genuine alternatives for thinking and doing to challenge and improve the customary ways of their tribe back home." (Benne and Demorest, 1970, p.11, 12)

As bad as the tourist reaction to messrs Benne and Demorest's model is, the expatriate reaction wherein the participant breaks all ties to the home environment while in the conference role is even worse. The primary attribute that each participant brings to a symposium is his understanding of the environment in his particular sector of the world. The symposium should build understanding from the blending of these differences in outlook, understanding, and experience. Therefore, ties to the home environment must be maintained if the maximum benefit is to be gained by any of the participants. Benne and Demorest recommend the following five principal steps that can be taken to induce symposium participants to behave more like thoughtful learners and less like tourists and expatriates.

1. The symposium should set a standard of active responsibility on the part of all participants for determining the goals of

the symposium and for working to achieve them.

2. The symposium should accept the standard that all participants are responsible not only to themselves and to the other symposium members but to their associates in the home setting as well.
3. The symposium should prepare resource persons to help to keep the symposium deliberations geared to the realities of the participants.
4. The symposium should clarify the problems of applying symposium outcomes to the world outside.
5. The symposium should discourage emphasis on irrelevant outside ranks or positions and should encourage the development of a status system in the conference which supports rather than thwarts symposium objectives. (Benne and Demorest, 1970, p. 15 - 19)

It is axiomatic that adequate opportunities for participation by all attendees must be offered, however, question and answer periods must be properly incorporated into the format if they are to provide the maximum benefit. Questions should be crystallized while they are fresh in the questioners' minds - written down during the presentation. Arrangements to have the questions screened, organized into categories, and combined where similar, and then presented to the speaker in time to allow him to prepare answers, provides a reasonable justification for a question and answer period to be a formal part of the symposium held at a <u>later</u> period than the actual presentation period. The question period is an important part of the overall program and must be recognized as such.

Another effective method of involving the audience is to form "interview panels". A panel of audience members representing various populations in the audience such as Navy labs, operating activities, industry users, etc., interviews a speaker from the viewpoints of the groups they represent. Such an interview panel can be used to start the question period. Margaret Mead states the "The conference situation is designed to permit the participants to act as whole individuals, using all their senses as they seldom do in the narrower, more specialized contexts of other forms of professional and academic life. The arrangements for the conference and the creation and management of conference style are second only in importance to the facilitation of the substantive intellectual exchange. The expectations with which participants attend a conference play an important part in its success. Attempts are often made to involve participants in pre-conference activities. These should include not only selection of participants but also the selection of subject matter to be included in the symposium". (Mead, 1970, p. 45)

C. FORMAL AND INFORMAL KNOWLEDGE FLOW

"There have been a small number of studies which examine the extent of use of formal vs informal knowledge flow enhancement factors. Formal knowledge flow enhancement factors are defined as publications and documented information and the processes enabling their dissemination, storage, indexing, retrieval; informal knowledge flow enhancement factors are defined as interpersonal communications channels of face to face contact, telephone, telegraph, messages, written correspondence and interpersonal beliefs, feelings and perceptions. Four such studies, Glock (1958) of 77 scientists, Auerbach (1965) of 1375 scientists, Rosebloom and Wolek (1967) of 3260 scientists and engineers, and Graham and Wayver (1967) of

326 managers of research and development projects, agreed within a few percent that the communication channel usage was divided, informal 55% and formal 45%.

These studies showed that the interpersonal or informal channels play a fundamental and important role and are utilized by individual scientists and engineers in a majority of the instances in their daily information obtaining activities." (Jolly & Creighton, 1974, p. 4)

The technology transfer symposium method provides the most effective means for concurrent use of formal and informal knowledge flow. Group meetings held for the purpose of discussing ideas can enhance the removal of communication barriers among the university, government and commercial institutions. The word gets around best when people talk to each other; the interpersonal network of communication is activated. A significant part of this is realized through clarification of terminology and thinking when minds are brought together in focus upon a single concept. "The greater the risk involved in the adoption of an innovation, the more important the personal sources of communication become". (Bauer, 1961)

The technology transfer symposium provides the attendee the opportunity to see what is going on outside his normal realm of activity. He can set aside his daily office routine, discover new ideas and make new acquaintances. He can learn what has been tried, what not to attempt, and benefit from others' mistakes and failures. Such rewards often are not immediately realized or recognized. One idea subsequently can spark a breakthrough; a breakthrough can form many branches.

It has been stated that linkers are born, not made. This point although highly debatable, will not be pursued here. Suffice to say, the

symposium can help develop those who have linker traits and instill in others who may not, a deeper appreciation for the linker role. The symposium agenda can be tailored so that it will encourage the active recruitment and training of linkers.

The technology transfer symposium provides a neutral ground for company executives to mingle with junior personnel from their own organizations as well as with those from other organizations. This enables management from different organizations to discreetly observe and evaluate each others' capabilities and characters. The attitude and degree of respect that peers and competitors hold toward a particular organization and key personnel within that organization can be ascertained easily by the alert attendee. Such information has proven invaluable to decision makers faced with problems such as vendor selection and credit allowances.

D. APPLICATIONS TO TECHNOLOGY TRANSFER

The symposium method must be adapted to meet the challenges of the times. Over the years the form of the symposium has been institutionalized without being noticed. The format of the symposium has developed along the lines of "how a symposium should be run" rather than being designed for the task at hand. Admittedly, the experience of the past has to be considered in any undertaking, but this experience must be viewed in the context of today.

There is now a cult of the present. Change has come about so rapidly and continuously that the past of even a few years back is often irrelevant. Further, in the midst of temporariness, the future seems even more distant because it is so unpredictable; but technology transfer requires a faith in the future and a belief in its relevance. Thus, the

transfer of technology requires that an environment be established which is comfortable with change.

In past years, while change has been rapid, the past has always been close enough to provide a basic stability to the world. Like the scales of a fish, our participation in modernity forms an overlapping pattern. Identification with the way that things have been done traditionally forms a strong base for our convictions. On the other hand, the cult of tomorrow, with its challenges and promises, provides us with a thirst for the avant garde. We have had to accomodate to what we felt to be real and possible. Thus, without realizing it, we live in a hypocritical world, in the breach between our professed confidence in the future and our reluctance to stick our necks out. Everyone searches for a firm middle ground where a comfortable compromise existence can be found. It is considered that the technology transfer symposium, properly designed to bring the attitudes and values of the participants into a form of interplay, allows a unification of purpose and perspective to emerge. The designer of the technology transfer symposium constantly must be aware of this need and constantly checking his own assumptions and values in order to uncover discrepancies between principles and practice. He must keep the overall end goal in sight and ensure that he is working toward this goal and not just following convention. If the effort is perceived by the participants as being an authentic attempt to achieve the stated goals, the symposium will be well along the way to success. Thus, the technology transfer symposium proposed for the trial effort in this paper does not follow convention, but rather is aimed at achieving a unity of purpose among the participants.

E. THE FORMAT

The format for the technology transfer symposium has been developed to permit the maximum interchange of ideas. While the symposium clearly belongs in the area of technology transfer mechanisms, the structure has been expanded internally beyond the mechanism stage, providing for the complete chain; problem definition, technology resource assessment, transfer mechanism, and establishment of a continuing communication channel between the technologist and the user. In order to standardize housekeeping procedures for this format, certain detailed planning assumptions have been made which tailor these symposia into a NMC program for the transfer of technology within and from the Department of Defense (DOD). This, however, in no way is meant to imply that the procedure is not totally general in nature and applicable in any area where dissemination of ideas and establishment of interpersonal communication is desired. The symposia are envisioned as a (CNM) sponsored and funded program. He, or his agent, would establish the schedule, define the discipline or technical area to be explored, initiate invitations to participants, publicize and in general support the symposium. One of the prime technology generating or using Navy activities would host the symposia. As an example, (NELC), both a major generator and user of technology would be a logical host for the proposed trial symposium on the technology of communications-electronics. The host would provide space and administrative support to the conference and, perhaps, act with the CNM representative as co-chairman. As stated in Chapter III, the majority of the effort in a symposium should be directed toward planning and preparation. For the initial program, the Postgraduate School files were used as a kernel around which to organize the technology

to be reviewed in the symposium. These theses represent a large, reasonably quantifiable store of technology which can be segmented easily into discrete subject areas. Initial planning calls for the identification of a subject and a search of theses, relating to the chosen subject, to identify potential candidates for transfer.

The subject area of communication-electronics was chosen as the initial endeavor. Professor O. M. Baycura of NPS made a search of theses on this subject to identify those theses representing innovative ideas and potential for further development. This list was submitted to CNM, NELC, NRL, NAVELEXSYSCOM, and DDR&E for review (Appendix B).

The next step in this preplanning stage is the establishment of a timetable for the symposium. As yet this has not been done. Also a tentative list of participants needs to be established and preliminary communications initiated to discuss the most promising technologies and the particular needs that the developers and the users recognize. In the communications-electronics area, participants such as NELC and NPS could represent the developers, and Naval Communications stations and Type Commanders could represent the users. Other DOD activities, other agencies (Department of Commerce, Federal Communications Agency (FCA), National Aeronautics and Space Administration (NASA)) and pure technology transfer agents (Dvorkovitz, Public Technology Inc., and NTIS also might be considered as participants.

Upon establishment of the initial plan (i.e., identification of the topic, establishment of the time frame, and identification of tentative participants and audience), detailed planning should begin. Initial communications with leading participants in the researcher/developer/user

areas might provide a perspective on the appropriateness of the initial topics reviewed. In the case of the communications-electronics proposal, DDR&E (Dr. Birch) added several suggested topics. Others should be expected from the other reviewers. At this time, an expected audience profile might be identified and the topic list tailored to this audience. The involvement of as many parties as possible in this topic review enhances the identification that each party feels toward the effort.

The next step would be the identification of a location and a host activity. The convenience of the location to most of the participants is a major consideration. The general attractiveness of the area chosen including facilities and general environmental factors also is of significance. The choice of NELC in San Diego as the host for the communications-electronics symposium provides an area that is both pleasant to visit and contiguous to a large concentration of private and government communication facilities and research activities. The convenience to private industry promotes a higher level of participation, particularly in the beginning. In its initial phases, much of the promotion of the symposium should be used in drawing an audience. It is considered that the benefits which each participant receives will be readily apparent during the course of the activities. However, these must be made apparent in advance in order to promote attendance.

Once the initial skeleton of the symposium is established, detailed planning for the agenda and scheduling should be performed. The audience profile and a topic outline should be submitted to each planned presenter in order to allow him to direct his presentation in conformance with the mood of the meeting.

Major technology generating organizations should be requested to

provide an outline of their general capabilities as generators of technology in the topical area of the symposium, and should present a brief description of their on-hand technology which has high potential for use. Also, to the extent possible, brief resumes of each high potential candidate should be forwarded in advance to using activities to allow some initial review.

Major users, including industry, should be requested to expand on those problem areas (topical area of the symposium), which confront them for which a technological solution would seem appropriate. Particular emphasis should be placed on those areas which might benefit from adaptation of the existing technological concepts or capabilities presented. The schedule should intermix presentations from users, developers, and researchers, and should allow ample opportunity for idea exchange. Formal question-answer periods, with written questions submitted beforehand, addressed to a panel, is considered an effective technique. Spontaneous questions should also be entertained during these periods. At different times, panels representing each phase of the technology utilization chain should be used. At least half of each day should be devoted to the idea exchange portion of the agenda. It is considered that group luncheons, and group dinners with unhurried cocktail hours also provide excellant opportunities for personal interaction. To foster the individual to individual relationship, at least two and preferably three days should be devoted to each symposium. The participation of private industry should be encouraged strongly because of its postion as a potential user and as an originator of technology.

Announcement of the symposium should make the maximum use of trade literature and other existing media. The Commerce Business Daily, NTIS

literature etc. can reach a much wider audience than a specific effort can achieve. Printed mail-out announcements also should be used, particularly to audience groups already identified. A part of this mail-out announcement should contain a short pre-questionaire which would be filled out and returned providing information on who is attending, what specific expectations they hold, their attitudes predispositions, interests, and experience.

The pre-symposium phase begins with an evaluation of the questionaires returned from the announcement and a restructuring of the tentative agenda to reflect this evaluation. After the final adjustments are made, a verification of all details should be initiated to ensure that the location is adequate and that arrangements are in order. Presentations should be solidified as to content, presenter, and position on the agenda. The format should use observer teams to follow and evaluate the symposium effort. Ideally these observer groups will contain members from each segment of the technology utilization chain, providing the opportunity for a multi-faceted viewpoint within the group. The function of the observer groups is to follow a particular aspect of the program with a view toward constructive criticism. Tentative assignment of the audience attendees and participants to the groups should be made prior to the first symposium meeting so that group formation can be established quickly with minimum disruption.

For a typical symposium, a three day, mid-week schedule is considered ideal, providing ample time for travel and group interaction. Under these circumstances it is envisioned that most of the presenters would arrive on Monday, to be ready to start participating on Tuesday morning. Thus most presenters would be available for a review of facilities and a quick

run-through in front of a peer group on Monday evening. This permits an early introduction of the principals to one another, a familiarization with the actual environment for the presentation, and an opportunity to point out serious incongruities in the general thrust and temper of the meeting.

The first day should open with introductions, a covering of administrative details, a review of what the symposium is trying to accomplish, and how it is to be accomplished. This leads into the discussion of the observer groups and their function and should culminate in formation of these groups. An early start to the first day is considered essential. This provides the maximum time together as a group, thus stregthening group identification.

The first morning should include a presentation by a user, a presentation by a developer, and one by a researcher. The last half hour before lunch should be devoted to questions and answers. The lunch should feature a speaker who would summarize a view from one perspective (preferably the R&D area) of technology utilization. The dinner and the second day's luncheon speakers respectively would represent the remaining two views.

The first afternoon would be an ideal place for the NPS to make its presentation, reflecting on the technology which had been developed and that for which the potential existed. Other Navy R&D activities would follow the school in similar presentations from their respective view points. The afternoon should finish a question and answer period chaired by a panel of R&D personnel (presenters in this area).

While possibly inapplicable in a specific case, some means should be

devised to keep the group homogenized. Prearranged seating or segregation into observer groups might accomplish this end. Four people at a table, with a mechanism to avoid congregation of old friends into polarized units is also effective in promoting group communication.

Similar patterns of presentation, summarization, questions and answers should be followed with users and developers. Again, other agencies and private enterprise should be brought into the activities to the maximum extent possible.

The last day should finish with a presentation of observer group impressions followed by a general question and answer period. The last question which should be addressed by the audience at large is, "How well were the symposium goals achieved?" Individual questionnaires should be given to each attendee at the end of the session, addressing roughly the same question but in a more personal context. Each symposium would follow a similar pattern modified as appropriate by the analysis of the effectiveness measurement data.

It is anticipated that the major areas in which the Navy has research capability for technological requirements would be identified by CNM. For planning individual symposia, each major area would be subdivided such that the topical coverage of any one symposium would be sufficiently unique, but so that meaningful coverage could be made in a two to three day period. Then a schedule should be established to present each topical area in a rotating fashion until all had been covered. Also, provisions should be made for repeating the cycle approximately once every four years if the anticipated benefits are realized.

The proceedings of each symposium should be compiled and distributed to participants and other interested parties by the CNM.

## IV. EFFECTIVENESS MEASUREMENT

### A. ROLE OF EFFECTIVENESS MEASUREMENT

The end use of a program such as has just been described is the promotion of the wider use of the technology and technological capabilities available within the NMC and the rest of the Navy. To the extent that this effort requires the expenditure of resources by the Command and other participating activities, these expenditures must be justified. The value of the results must exceed the cost of the effort. Therefore, some means must be developed to monitor the results of this program to ensure that it is effectively performing the function for which it was designed, i.e., promoting the transfer or alternate utilization of technology producer, the technology developer, and the end users. This is a difficult assessment to make. As previously discussed, some technology transfer always will occur by diffusion over an extended period of time. Any measure of the <u>total</u> amount of technology transferred must be able to identify and remove the effects of technology diffusion or transfer from other sources if it is to be used as an indicator of the effectiveness of a particular technology transfer effort. Given that this were possible, the "amount" of transfer accomplished still would be nebulous. Such measures as the dollar value of technology effectively used in a secondary application, the number of new products developed using a particular item of new technology, the dollar value of sales resulting from an application of new technology, numerous other measures and innumerable ratios among them, all can be validly argued to be effective indicators, but also may show conflicting results.

Clearly the evaluation task is two pronged; not only must effectiveness

of this particular symposium be judged against symposia in general, also it must measure the effectiveness of the symposium as a transfer instrument when compared to other instruments or techniques. More emphasis is placed on the former question primarily because of the general intractability of the latter. However, the overriding importance of the latter question is recognized. The assumption is made that an effective symposium will be an effective technology transfer instrument.

B. ESTABLISHMENT OF A MEASUREMENT SYSTEM

A good symposium will have benefits which are much more far reaching than just the technology which will be transferred in the short term. Creighton, Jolly and Denning recognized that technology transfer was not just the communication of information. They identified the technology transfer process as a complex interaction between people. (Creighton, 1972 p. 3) By developing channels of communications among the participants, many other benefits are received in terms of future technology which are oriented more toward user requirements and which are better adapted for multiple uses. Many of these benefits are seen best in a change in traits of the participants. It seems reasonable, therefore, that some type of multimeasure is necessary to provide a good surrogate of symposium effectiveness.

Jolly in his Study of the Technology Transfer Capability of Eleven Organizations (Jolly, 1975, p. 153 - 155) uses the multivariate approach to measuring the technology transfer capability of the organizations studied. Jolly points out that a requirement is to determine the relative weighting factors for the variables measured. (Jolly, J.A., 1975, p. 161) No effort has been made in his or this effectiveness model to differentiate the importance of the effectiveness indicators. The reasons are the lack

of a basis for comparison, and the difficulty of measuring individual factor effectiveness without an extensive experimental program. Also, as hypothesized by Jolly, the factors are likely to change from group to group. Traits which come to mind which should show the impact of an effective symposium are:

Knowledge - Obviously, acquiring knowledge of new technologies revealed during the symposium would be a result. Also included in this category would be the knowledge of the other roles, capabilities, needs, and motivations.

Awareness - An effective symposium should make the participant aware of the technology transfer problem and of the people and organizations involved in disseminating technology.

Effectiveness - The participant who is favorably acted upon by the symposium environment should be more effective in his endeavors because of his new awareness and knowledge.

Attitude - The change in effectiveness outlined above should come partially from a modification of attitude toward the technology utilization process.

Behavior - An appreciation of the technology utilization process and the mechanics of technology transfer should cause a change in the work behavior of the individual wherein he would have a greater tendency to make use of the alternate sources of information which might be opened up to him.

Values - Ideally, the value of technology transfer would be perceived and the value of technology as a means to an end rather than an end in itself would be gained.

Thus, a measurement system which could determine changes in the above traits could be expected to be a valid indicator of the effectiveness of the symposium. The ability to measure this effectiveness also should enable the symposium organizer to make changes in format and to evaluate the impact these changes have on effectiveness. Therefore, it provides the capability, over time, to optimize the benefits received from the symposium.

Every person, either consciously or unconsciously, evaluates every meeting of which he is a part. What is not always done is to use the information available from these evaluations, systematically reviewed, to find out how we are doing and how improvements can be made. According to Beckhard, one of the important evaluation techniques recently developed is the use of evaluation as an integral part of the process of planning a symposium or meeting, rather than just attaching it at the end of the process. (Beckhard, 1970, p. 101) By gathering facts throughout the symposium process and providing the flexibility to make the necessary changes, the overall effectiveness can be increased greatly. There are several places in the process where evaluation is critically important. They are:

1. In the initial planning.
2. When firming up the final program plan.
3. Immediately after the symposium.
4. After a "retrospection and cooling down" period following the meeting.

Every symposium has a number of stated objectives; i.e., to disseminate technical information, to build communication ties, to create an awareness of the goals, outlooks, capabilities and problems of other members of the technical communities. In addition to these stated objectives, usually there are a number of unstated objectives such as enhancement of the sponsor's position in the technology transfer field, increased use of the known capabilities such as the Postgraduate School, thus providing for their continued support by the sponsor, and the opportunities for a display of capabilities of which an organization justifiably may be proud. The initial format must recognize all of these goals and objectives. An initial discussion with the major participants of the proposed details of the symposium allows inputs to be made early in the process, and allows a first cut evaluation of the proposed symposium format. As pointed out earlier, this also builds the participants' identification with the symposium. A second area where evaluation is critical is in finalizing the program, setting methods of presentation and determining what audience-participation methods are to be used. Beckhard states, "Every single item of subject material on a program should be related to these two questions:

1. What is the nature of the material (technical, philosophical, controversial)?
2. What is the situation in which it will be presented (activities that precede and follow it, level of audience interest in the subject, level of audience familiarity with the subject)?' (Beckhard, 1970, p. 103)

A dress rehearsal review of the presentations and a mock run-through of the format, aided by some critical reviewers, can bring large rewards at this stage.

It is considered that multi-methods must be used to obtain a true evaluation of the traits mentioned earlier such as knowledge, awareness, etc. Any individual measurement technique has built-in discriminators which cause a variable sensitivity as different subjects are measured. A multi-method approach to trait measurement provides an opportunity for the various inaccuracies to balance one another.

The evaluation techniques of several agencies which use symposia as an agent of technology transfer were reviewed to determine the measures they used, how they gathered the data, and how representative they perceived the data to be. This information was gathered through both phone and personal interviews with the technology transfer personnel in the agencies involved who were directly associated with the symposium effort. These included private efforts (Dvorkovitz), agencies associated with direct technology utilization (EPA), agencies involved directly in the process of technology transfer (NTIS), and Educational Institutions (NPS, Massachusetts Institute of Technology (MIT)).

> "Dvorkovitz & Associates act as a broker between innovators and users. Much of their transfer is done on a one-on-one basis, however, over the years Dvorkovitz has held a number of Industry/Innovator Forums, which led up to the First World Fair for Technology Exchange in February 1976. Dr. Dvorkovitz is involved in a profit making business. Therefore, as one might expect, a primary measure of effectiveness for him is the continued profitability of the company. Compilations of the numbers of licenses resulting from a symposium or fair are used as a measure and interviews with participants, both exhibitors and searchers, provide another source of evaluation. Questionnaires, testimonials, and direct observation of the proceedings are also used to a lesser extent as effectiveness indicators. Dr. Dvorkovitz believes that the primary benefit of the Fair is to bring the parties together where they can see the potential benefits of using his service for locating technology, or for finding users for technology." (Unit 1976)

> "The EPA is interested in bringing the results of modern technology to bear on the problems of environmental protection. They seek not only to influence those who design plants which might have an impact on the environment, but to bring the state of the art as to what is possible and how to achieve it to

other regulatory agencies and law makers. Because of the close relationship between users and the EPA, measuring the degree to which the new technology is adopted is reasonably easy. No attempt is made to segregate technology transferred by symposia from that transferred by other means, or from that imposed by legal requirements. Some questionnaire investigations have been made, of format effectiveness, but, primarily, format is developed along the lines of what 'feels right.'"(Appendix A EPA)

"The National Technical Information Service is directly in the business of transferring technology. They have found that the symposium approach brings the services of NTIS into open view and gives the participants, whether or not they receive any direct technical benefit from the symposium, an appreciation for what capabilities NTIS has to offer. NTIS, like Dvorkovitz, uses the number of licensing agreements which result from their efforts as a primary means of measuring their effectiveness. Effectiveness is also judged by questionnaires and testimonials." (Appendix A NTIS)

"The Naval Postgraduate School has given symposia on technical subjects which lend themselves to transmitting new technology to users who had previously been unaware of its existence; and also in the area of Technology Transfer itself." (Jolly, Creighton, 1975)

"The MIT took an interesting approach to the technology transfer symposium by having the technology seekers in the retail food industry present the problems they faced to a group of innovators." (Bloom, 1975)

The program resulted in a direct appeal to the technologists by the end users of their products. Unfortunately, no means was established to monitor the effectiveness of the effort. As can be gleaned from the above data, the questionnaire is by far the most popular means of gathering direct data on which to try to measure effectiveness. In general, there does not appear to be any really solid approach to measuring technology transfer effectiveness. Both NASA and the Civil Engineering Laboratory (CEL) have quantified the results of their efforts on technology transfer in general, based on questionnaire data and licensing agreement counts. Only CEL has tried breaking down the results as to their proximate causes. (Early, E., 1975, p. 139) As the questionnaire does represent a direct

and reasonably effective means of gathering primary data, this method is used extensively in the proposal for the proposed NMC technology transfer program. Observational evaluations, personal interviews, and technology use counts also should be used and the effectiveness judged as a composite result of the different indicators.

C. MEASUREMENT MECHANISM

It is recommended that data be gathered at three separate times via questionnaire; before the symposium, immediately following the symposium, and 60 days following the symposium. The purpose of the data gathering is to measure changes in traits or attitudes and to provide some indication of the permanence of the changes noted. Also this method should provide some indication of the extent that participants' expectations are being met. Proposed questionnaires for the pre, post, and follow-up surveys are included in Appendix C. The presurvey questionnaire seeks to determine the individual's interest in technology transfer and his experience with the subject. His attitudes and predispositions, as well as expectations are probed. In general, the factors mentioned earlier; knowledge, awareness, attitude and values, are used to establish a base line. Expectations and suggestions are taken as indicators of what goals the symposium should seek to fill. The post symposium questionnaire generally measures the same parameters to discern any changes. Also explored are how well the expectations were met, suggestions for a more effective symposium, technology gained which will be or which might be used, and unexpected benefits perceived. The follow-up survey will be primarily an inquiry into self perceived benefits, but will explore the numbers of technological innovations actually put into use, numbers of new contacts maintained and numbers of technological innovations which are being considered which would not have been considered previously.

It is considered that a series of random personal interviews, held informally during the course of the symposium, pursuing essentially the same information as the questionnaires, would add enriching information. Also with sufficient correlation, it would provide an insight into the biases of the questionnaire method of measuring the same parameters on a more general scale. The parties interviewed should be chosen so as to represent a cross-section of the attendees. However the interviews should be initiated in a seemingly unplanned manner to minimize a perceived relationship with the questionnaire survey.

A group of prebriefed observers should follow the whole symposium effort noting: How the individual presentations were received by the participants, the informal comments among themselves during breaks and meal periods, and the extent to which technology transfer was a part of their extra-meeting awareness. A listing of possible indicators to look for during various phases of the symposium is contained in Appendix E. Observations of course can (and should be) made by the organizers of the symposium. However, another source of observer data is observer groups formed to evaluate various aspects of the symposium. These groups should be made up of participants and audience alike. In addition to giving an unbiased review, the group would provide a different perspective than any one person would give. In addition, the integration of the group into the symposium process would be another way of enhancing identification of the participants with the goals of the symposium, and of reinforcing these goals in their conciousnesses.

Counting measurements provide still another means of indicating the effectiveness of the symposium. Such counts might be: counts of the number of new ideas gained, new contacts made, new innovations developed from the technologies gained, and in the case of the trial effort symposium,

the numbers of thesis requests received at the Postgraduate School in the subject area of the symposium (Communications Electronics), as well as the numbers of theses initiated by the symposium to examine outside areas. Moreover, the counts might provide some quantitative data which could be used to support dollar based justifications.

A method of evaluation to be used last might be a peer group open analysis session of the symposium to be held at the end of the proceedings, and addressed to the question: "Has this symposium been effective and how might it be improved?"

D. EVALUATION OF DATA

Evaluation of something as complex as the effectiveness of a symposium must, of necessity, be relative. It is considered that a matrix formulation of the results of the various indicators as measured by the questionnaires, interviews, and observations, would provide a comprehensive view of the results while showing the individual variations which were revealed. Figure IV-1 below shows how such a matrix might look. Value ranges are from 1 to 5 corresponding to unsatisfactory, disagreeable, no benefit, beneficial, extremely beneficial, respectively.

FIGURE IV-1

EFFECTIVENESS MATRIX

| | Pre/Post Quest | Pre/ Follow-up Quest | Observe | Interview |
|---|---|---|---|---|
| Increased technological knowledge | 5 | 4 | 3 | 3 |
| Increased knowledge of technology transfer | 4 | 5 | 5 | 5 |
| Awareness of technology transfer ideal | 2 | 3 | 4 | 3 |
| Attitude toward technology transfer | 4 | 3 | 4 | 5 |
| Value placed on technology | 5 | 3 | 4 | 3 |

Denotes a possible arrangement of the data gathered on the effect of the symposium on attendee traits

## V. ANALYSIS AND CONCLUSIONS

The objectives of this study have been: (1) to devise an effective means of transferring the technology developed in the Navy to other potential users, and (2) to promote mutual understanding and communication among the members of the technology utilization chain. Determination of the degree to which these objectives have been achieved will require actual implementation of the trial program, including the effectiveness measurement analysis. However, a comparison can be made at this point of the salient features of the symposium program with the requirements for effective communication/utilization as set forth by Havelock in his model of Resource-User Problem-Solving shown in figure V-1 (Havelock, '74). Havelock proposes analysis of conformance to this model through a set of ten principles summarized by the acronym H-E-L-P S-C-O-R-E-S. (See Figure V-2). The principles involved are:

Homophily, or the similarity between the participants in terms of age, sex, education, occupational role and background, social and economic background, life style, modes of thought and values. This is normally a condition over which one has little control. To the extent that active duty Naval Officers are rotated through different roles in the technology utilization process, there is a greater degree of homophily among intra-Navy participants than might be found among participants outside the Navy. This is particularly true of researchers at the Naval Postgraduate school and other Navy developmental and using activities. The symposium itself, however, would have little impact on homophily.

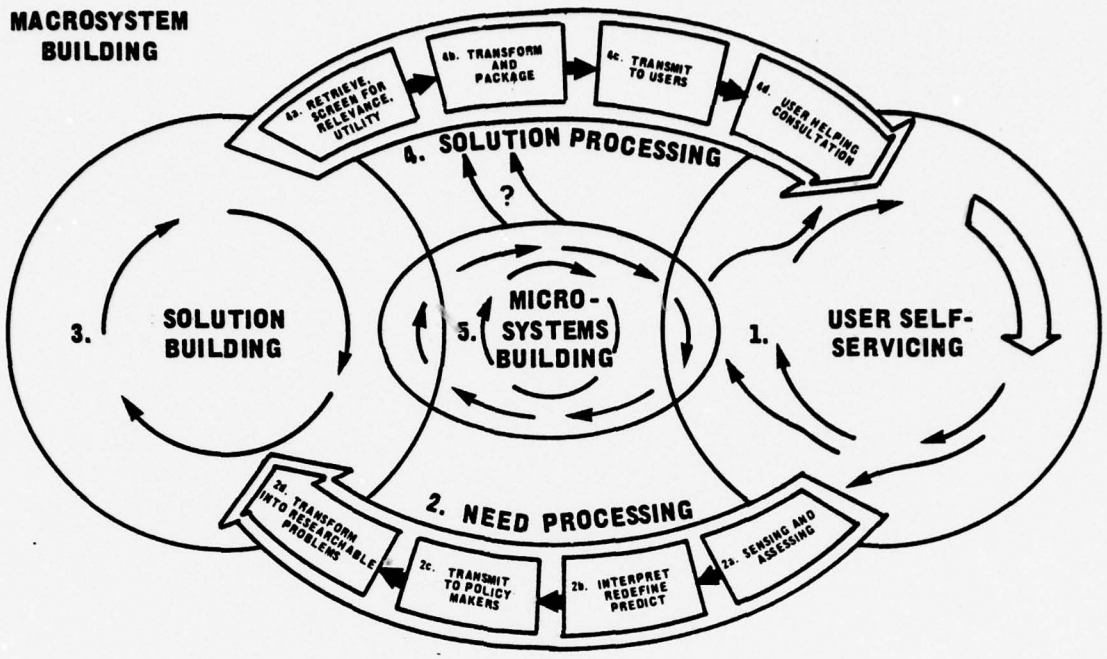



FIG V-1

SOCIETAL KNOWLEDGE FLOW

Empathy, or understanding and appreciation of the capacity, limitations, needs, processes and values of the other particpants. The integration of purpose which should be sought in the symposium would be accomplished by integration of the participants into the symposium planning, execution, and evaluation. Thus it would promote a mutual exchange of ideas, values, perceptions, and expectations. Also it would expose each participant to the variety of idiomatic expressions and language styles used. Further, the symposium format was designed to provide a presentation from each major area of the technology utilization process. Therefore, it is considered that the symposium program as proposed would build empathy.

Linkage, or an interaction of positions. While closely connected with empathy, linkage involves a simulation, at least in the mind's eye, of the other's position. Presentations during the symposium by representatives of all areas in the technology utilization process have been included specifically to help stretch the imaginations of the audience into identifying with the positions being presented. Short of exchange assignments of individuals among communities, the symposium program is considered to be the most effective means to provide the maximum interaction or linkage of roles.

Proximity, or closeness and ready access to diverse resources and other members of the technology utilization process, is the particular forte of the symposium method. The program was designed to bring not only all members of the technology utilization process together, away from the distractions of the everyday environment, but to provide a maximum opportunity for informal contact, exploration, and exchange of ideas through an integrated social program.

Structuring, or a systematic planning of the program with integrated social organizations and a coordinated division of functions and labor, was another primary design goal of this symposium effort. The entire symposium process is an integrated structure bringing the participants together in the initial planning stages and building on this interrelationship through the formal presentations, informal activities, and the evaluation process. In this way a coherent chain would be forged from beginning to end, leading the participant from a position of a specialist in one area of the technology utilization program to that of a team member of the Navy technology utilization team.

Capacity, or the ability to transmit the maximum amount of information to the widest number and array of "users", requires a definition of terms to be applied in this context. The role of "user" in this connotation would involve all participants in the technology utilization chain. The user of technology would use the information he gains on what technology is being developed, or is available from the research activity. Also he would use the information on the product being developed for his use. The developer of technology similarly would use the information he gains about the researcher and the end-user. The researcher, by becoming aware of the problem the end-user faces and the economic and capacity constraints of the developer, and by tailoring his research to meet these needs and constraints, also would use the information he gains from the interchange of the symposium. Thus by utilizing both group-to-group and one-on-one interchanges, away from other distractions, the symposium was designed to achieve "full flow" open communications. Combined with the proximity previously

discussed, this should provide almost limitless capacity within only the time constraints of the symposium direction. The contacts and empathy gained over the course of the symposium should afford the continuance of some capacity for idea exchange. Therefore, the symposium is considered to meet the requirement of capacity.

Openness, which relates to flexibility, accessibility, and willingness to be influenced and adapt to outside influences, is more a personal characteristic than those previously discussed (with the exception of homophily). Havelock hypothesizes that the best medium would allow continual communications among participants about innovation (see figure V-2). Intuitively this seems logical in that, to the extent that closed mindedness is a result of a closed environment, the continual exposure to new ideas and new paradigms would provide challenges to perceived "truths" that are based on conditioning and not on fact. The participation of an individual in a symposium, the expressed purpose of which is the exchange of ideas, would indicate a certain degree of openness, or at least an inclination toward openness. To the extent that this inclination can be developed, it is considered that the symposium would provide a viable mechanism for this expansion.

Reward, or perceived benefit to the participant, might be measured in dollars, recognition, increased knowledge or self-esteem. However, there are two qualifications to any measurement. The reward, almost by definition, must be valued by the recipient. Further, for those intangible rewards such as increased knowledge, recognition, or self-esteem, the recipient must perceive that he will receive these benefits by participation. Their actual accrual, without his knowledge that they are a result of the symposium experience, provides little

# H-E-L-P S-C-O-R-E-S

## A CHECKLIST FOR PLANNING AND DIAGNOSING HELPING RELATIONSHIPS

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HOW GENERAL FACTORS RELATE TO

| GENERAL CHANGE PROCESS FACTORS | RESOURCERS (PERSONS & SYSTEMS) — SENDERS-DISSEMINATORS (WHO) | USERS (PERSONS & SYSTEMS) — CONSUMERS-CLIENTS (TOWHOM) | MESSAGE — KNOWLEDGE INNOVATION (WHAT) | MEDIUM — CHANNEL-STRATEGY—TACTICS (HOW) |
|---|---|---|---|---|
| HOMOPHILY | SIMILARITY TO USER IN AGE, SEX, EDUC, OCCUP, ROLE AND BACKGROUND, APPEARANCE, LIFE STYLE, SPEECH, MODES OF THOUGHT, VALUES, ETC. ALSO SIMILARITY IN THESE RESPECTS TO OTHER RESOURCE PERSONS. | SIMILARITY TO RESOURCER IN AGE, SEX, EDUC., OCCUP, ROLE AND BACKGROUND, SOC. ECON. BACKGROUND, APPEARANCE, LIFE STYLE, SPEECH, MODES OF THOUGHT, VALUES, ETC. ALSO SIMILARITIES – HOMOGENEITY AMONG MEMBERS OF USER SYSTEM AND BETWEEN USER SYSTEMS. | SIMILAR TO OTHER MESSAGES TYPICALLY RECEIVED. SIMILAR CONTENT. | SIMILAR TO SAME MEDIUM AS TYPICALLY USED BY USERS. SIMILAR, FAMILIAR LANGUAGE STYLE. |
| EMPATHY | UNDERSTANDING AND APPRECIATION OF USER'S SITUATION, NEEDS, PROBLEM-SOLVING PROCESS, VALUES, ETC. | UNDERSTANDING AND APPRECIATION OF RESOURCER'S CAPACITY, LIMITATIONS, NEEDS, PROCESSES, VALUES. | RELATEDNESS AND CONGRUITY TO USER'S SITUATION NEEDS, PROCESSES, VALUES. | ALLOWS TWO-WAY COMMUNICATION OF NEEDS, PROCESSES, VALUES. |
| LINKAGE | COLLABORATION, TWO-WAY INTERACTION WITH USER AND OTHER RESOURCES. SIMULATION OF USER'S PROBLEM-SOLVING PROCESS. | COLLABORATION, TWO-WAY INTERACTION WITH OTHER USERS AND RESOURCES. SIMULATION OF RESOURCE SYSTEM'S R&D PROCESS. | RELEVANCE TO USER ADEQUACY OF DERIVATION AND CONGRUENCE WITH SCIENTIFIC KNOWLEDGE. | ALLOWS DIRECT CONTACT. |
| PROXIMITY | CLOSENESS AND READY ACCESS TO DIVERSE RESOURCES AND TO COSMOPOLITENESS. | CLOSENESS AND READY ACCESS TO RESOURCES AND OTHER USERS. COSMOPOLITENESS. | | EASILY ACCESSIBLE MEDIUM. BRINGS RESOURCES AND USER TOGETHER. CUTS DISTANCE BETWEEN THEM. |
| STRUCTURING | SYSTEMATIC PLANNING OF D&U EFFORTS DIVISION OF LABOR AND COORDINATION. | SYSTEMATIC PLANNING AND EXECUTION OF PROBLEM-SOLVING EFFORTS. INTEGRATED SOCIAL ORGANIZATION OF RECEIVER SYSTEM | COHERENCE SYSTEMATIC PREPARATION (DESIGN, TEST, PACKAGE). | SYSTEMATIC STRATEGY. TIMING TO FIT USER'S PROBLEM-SOLVING CYCLE. |
| CAPACITY | ABILITY TO SUMMON AND INVEST DIVERSE RESOURCES. SKILL AND EXPERIENCE IN THE HELPING-RESOURCE PERSON ROLE. POWER, CAPITAL | ABILITY TO ASSEMBLE AND INVEST INTERNAL RESOURCES. SELF-CONFIDENCE, INTELLIGENCE. AMOUNT OF AVAILABLE TIME, ENERGY, CAPITAL. SKILL, SOPHISTICATION. | INNOVATIONS WHICH RESULT FROM HEAVY INVESTMENT AND SOPHISTICATED DESIGN AND DEVELOPMENT WILL DIFFUSE | CAPACITY OF MEDIUM TO CARRY MAXIMUM INFORMATION. ACCESSIBILITY TO MAXIMUM NUMBER OF USERS IN MINIMUM TIME AT MINIMUM COST. |
| OPENNESS | WILLINGNESS TO HELP READINESS TO BE INFLUENCED BY USER FEEDBACK AND BY NEW SCIENTIFIC KNOWLEDGE. FLEXIBILITY AND ACCESSIBILITY | WILLINGNESS TO BE HELPED, DESIRE TO CHANGE, TO SEE POTENTIAL OF OUTSIDE RESOURCES. ACTIVE SEEKING AND WILLINGNESS TO ADAPT OUTSIDE RESOURCES. | ADAPTABILITY, DIVISIBILITY, DEMONSTRABILITY OF THE INNOVATION. | FLEXIBLE STRATEGIES BEST MEDIUM ALLOWS CONTINUAL COMMUNICATIONS BETWEEN SENDER AND RECEIVER ABOUT THE INNOVATION. |
| REWARD | REWARD FOR INVESTMENT IN D&U ACTIVITIES IN TERMS OF DOLLARS, RECOGNITION, KNOWLEDGE, SELF-ESTEEM. | PAST EXPERIENCE OF REWARD FOR UTILIZATION EFFORT. RETURN ON EFFORT INVESTED IN DOLLARS, TIME, CAPACITY, GROWTH, WELL-BEING. | RELATIVE ADVANTAGE PROFITABILITY. TIME AND LABOR SAVING POTENTIAL. LIFE-LIBERTY-HAPPINESS BENEFIT POTENTIAL. | MEDIUM WHICH CAN CONVEY FEEDBACK ( AND – REINF.) MOST EFFECTIVE MEDIUM HAS BEST REWARD HISTORY FOR SENDER AND RECEIVER. |
| ENERGY | WILLINGNESS, ABILITY TO INVEST TIME, TO PERSIST IN THE FACE OF DIFFICULTIES. ABILITY TO ENERGIZE OTHER RESOURCERS AND USERS, TO SUSTAIN HIGH EXPECTATIONS AND POSITIVE IMAGES OF POTENTIAL | WILLINGNESS TO EXPEND EFFORT ESPECIALLY OVER THE LONG HAUL TO MAKE CHANGE WORK. ENTHUSIASM, DEDICATION, COMMITMENT TO CHANGE, AND TO CONTINUED USE OF RESOURCER. | FORCEFUL, INSPIRING DISCONTENT WITH STATUS QUO, DESIRE TO MOVE TO NEW STATE. ALSO REDUNDANCY. KEY ASPECTS OF MESSAGE SHOULD BE REPEATED AS THEMES THROUGHOUT TOTAL MESSAGE PACKAGE. | SHOULD HAVE IMPACT FOR THE PARTICULAR USER. SHOULD ALSO ALLOW FOR REDUNDANCY—REPEATED SENDING-RECEIVING ON SAME-DIFFERENT CHANNELS. |
| SYNERGY | THE NUMBER AND DIVERSITY OF RESOURCE PERSONS. CONTINUITY AND SYNCHRONIZATION OF EFFORT. | THE NUMBER AND DIVERSITY OF DIFFERENT USERS REACHED WILL ACCELERATE AND DIFFUSION TO SOCIAL SYSTEM AS A WHOLE. | THE NUMBER AND VARIETY OF FORMS IN WHICH THE MESSAGE APPEARS AND THE CONTINUITY AMONG FORMS. | THE NUMBER, DIVERSITY, AND CONTINUITY OF MEDIA USED TO TRANSMIT THE MESSAGE. |

FIGURE V-II

motivation. The primary rewards to be gained from the symposium would be increased knowledge, recognition and self-esteem. For this reason, the effectiveness measuring system, which in part would investigate increased knowledge of the participants, and which would involve the participant actively in the measurement process, would identify to the participants increased knowledge as a result of participation. This, in turn, would provide recognition and a sense of self-esteem.

The last subject to be addressed at the symposium would be, "Was it worthwhile?" If the individual's answer is, "Yes," he would perceive a benefit or reward. If the answer is, "No," the effectiveness measurement systems would be designed to determine, "Why not," and to correct the deficit.

Energy, or the ability to energize other resources and users, and to sustain high expectations and positive images of potential, would be achieved in the application H-E-L-P S-C-O-R-ES profile to symposium design through the use of a forceful message inspiring discontent with the status quo and a desire to move on to a new state of awareness. The key aspects of the message would be repeated as themes. As in this paper, the symposium would maintain the theme of mutual understanding throughout its tenure. While individual technological innovations might be introduced in the formal presentations at only one point, the question-and-answer periods and the multiple opportunities for informal discussion would allow multiple exposure to these innovations. In any case, the concept of capability, which is an integration of individual technological achievements or individual operational problem needs, should be built up during the whole symposium. Every effort should be made to make the presentations

understandable, dynamic, and relevant. In this way enthusiasm or energy would be developed. The participation of all attendees in the solution of mutual problems would maintain this enthusiasm.

Synergy is defined as the number and variety of forms in which the message of the symposium appears, and the continuity that appears among the forms. As it relates to the medium, (the symposium itself) it would be a measure of the number, diversity and continuity of the means used to carry the message. While the presentations during the symposium undoubtedly would make use of multi-media techniques involving both audio and visual stimuli, (including to some degree demonstrations) the symposium really constitutes a single medium. Only the presentation of the theme at multiple levels of awareness (behavioral, conceptual, logical and even, to some extent, emotional) would qualify the symposium to meet the requirement of synergy. As pointed out in Chapter III, the effectiveness of the symposium would be judged by the extent to which it involves the whole person. At this point in time, it can be stated only that the design of the symposium would totally involve the participant. In this regard, it is conceptually attuned to the expanded definition of synergy described above.

Thus, through an analysis of the symposium program for technology transfer using Havelock's H-E-L-P S-C-O-R-ES criteria developed in this paper, it is concluded that the symposium program would be an effective instrument for technology transfer. The large number of other symposia being held, both within the Navy and by other agencies, is indicative of a wide acceptance of this precept. In general, however, these other symposia are considered to be lacking in one or more essential aspects. Most involve a straight presentation of innovative ideas to

developers (or manufacturers) without providing a feedback loop to determine if these innovations meet the practical economic and capability constraints of the developer, or if they fill any real requirement of the market place. For example, the Small Business Administration (SBA) held one seminar where the technology to weld a flat 35 foot diameter aluminum ring was presented to a group of small manufacturers. Only after the seminar was concluded was it discovered that, not only was the capability (from a shop standpoint) not generally available to the audience, but the market for 35 foot diameter flat aluminum rings was next to non-existent (Lang, Appendix B)

Another general shortcoming is lack of an integration of effort, either within the individual symposium or within the many symposia being held. The EPA came closest to an integrated purpose with a standardized approach to symposia (Crowe, 1976). However, it was restricted in audience to a specific area of technology. The Navy program presented herein provides for an integration of purpose, schedule and design ensuring that all areas of technology will, in time, not only be covered, but will be related to the overall design of technology transfer.

Lastly, most symposium systems have no direct effectiveness measurement system. Thus, there is in most cases no means available either to ensure optimization of the symposium format or to demonstrate its overall effectiveness in achieving its end goal.

In the course of this study, the requirement for technology transfer in general was examined, the means to achieve meaningful transfer was explored, and the symposium method identified as an effective means of opening technology transfer communications channels. The symposium method was examined, and an integrated technology transfer symposium

program designed for the Navy. This includes an initial trial effort and an effectiveness measurement system to attempt to demonstrate the extent to which it meets its design objectives. This symposium system was then evaluated using Havelock's H-E-L-P S-C-O-R-ES analysis, which demonstrated at least the potential of the program to motivate and develop technology transfer within the Navy.

The program contained herein is considered an effective means of developing technology transfer within the Navy. Its early adoption is recommended.

## VI. RECOMMENDATIONS FOR FURTHER STUDY

The following areas of study are recommended as follow-on actions to this effort:

1. Determine the optimum format for presentation of material in the symposium.

2. Determine the appropriate weighting that should be given to each factor considered as an indicator of symposium effectiveness.

3. Determine the relative biases of the methods used to gather data on symposium effectiveness, and design a simplified measurement system which would provide an objective measurement of effectiveness.

4. Determine the long range effect of the symposium as a means of changing the individual's awareness of, and appreciation for, the technology transfer view of technology utilization.

5. Develop a Technology Transfer Symposium Handbook, to be used as a basis for all technology transfer symposium efforts in the Federal Government. This handbook should contain chapters related to subject selection, audience selection, audience involvement methods, symposium format, goals of the program, and effectiveness measurement techniques.

6. Investigate an approach to integrate the present efforts for diffusion of federal technology.

If the symposium program is approved as a Naval Material Command sponsored technology transfer method, the symposia themselves should provide the vehicles for the majority of these studies. If the symposium program is not approved, the investigations are still considered feasible and worthwhile as a guide for any symposium.

APPENDIX A

## TECHNOLOGY TRANSFER BACKGROUND AND HISTORY

### A. ENVIRONMENT

The importance of technology transfer is well recognized at the highest levels of government. However, prior to a discussion of its significance, a comprehensive definition of technology transfer should be provided. Technology transfer may be defined as ".... a purposive continuous effort to move technical devices, material, methods and/or information from the point of discovery or development to new users. (Gilmore, John 1964)

From this definition, it can be observed that technology transfer, in effect stimulates new use of existing information. It is not important whether the idea is new, only that it is new to the person adopting it.

Former President Richard M. Nixon, in a special message to Congress on Science and Technology on March 16, 1972, emphasized the need for the Federal Government to actively disseminate this technology to the public and priviate sectors in an attempt to increase the economic benefits of our tremendous inventory of technical discoveries.

The 94th Congress of the United States enacted, and on May 11, 1976 . President Ford signed, Public Law 94-282 titled, "National Science and Technology Policy, Organization and Priorities Act of 1976". This act declared that " ....the general welfare, the security, the economic health and stability of the nation, the conservation and effective utilization of its natural and human resources, and the effective functioning of government and society require vigorous, perceptive

support and employment of science and technology in achieving national objectives ...."

One of the provisions of this legislation is the establishment of the Federal coordinating Council for Science, Engineering and Technology. Among the many other duties of this council, is to recommend policies and other measures designed to, ".... identify research needs including areas requiring additional emphasis, achieve more effective utilization of the scientific engineering and technological resources and facilities of Federal agencies ....". This legislation also provides for a President's Committee on science and technology. This committee is empowered to, "....survey, examine and analyze the overall context of the Federal science engineering and technology effort....". It is also to consider needs for ".... improved methods of effecting technology innovation, transfer and use ....".

B. INCREASING COMPLEXITY OF THE ENVIRONMENT

The recognition by both the Congress of the united States and the incumbent President of the importance of technology transfer is taking place at a time when the technical environment of the world is growing in complexity at an exponential pace.

Problems of excessive population, contaminated environment and diminishing natural resources have all been with the human race, at least in incipient form, for a long time, but now the inevitable disaster which they portend is within devastating proximity.

C. HIGH COST OF R&D

The day of the innovative, inquiring researcher using empirical methods in a backroom laboratory and making earth shaking scientific

discoveries is long gone. Today even the most modest high school level physics or chemistry laboratory, designed to convey only the fundamentals of what is well known to a new generation of students, represents a staggering investment. Providing the facilities and manpower to move out the frontiers of science further is a phenomenal burden even for a nation as wealthy as the United States. This circumstance further highlights the importance of transferring and applying the vast amount of unused technology that is now backlogged.

Sources of technology available for transfer are myriad. Of course, one of the best known is the National Aeronautics and Space Administration (NASA). Even apart from its primary goal of space exploration, it has made significant contributions to improved communications, weather forecasting, and to an understanding of the universe. Fortunately, there is incorporated in NASA a secondary mission which is the utilization of the technology which it has developed. There has been established an Industry Affairs and Technology Utilization Office which has enabled the technology developed by NASA to be applied to thousands of products and processes throughout the nation. Successful applications grow each year, but much more can be done to improve the transfer process. (Ruzic, N., 1976, p.4,5)

The Department of Commerce, through its U.S. Patent Office, is a fertile source of technology available for transfer. The first U.S. patent, bearing the authorizing signatures of George Washington and Thomas Jefferson was issued on July 31, 1790. In 1975, as the United States entered its Bicentennial year, the Patent and Trademark Office development was approaching issuance of its four millionth U.S. Patent. This development, of course, is not limited by National boundaries.

Since a patent obtained in the United States usually conveys no protection outside this country, and vice versa, it is common in this age of the international market place for investors to obtain patents in more than one country. As a result, significant foreign inventions are almost always patented in the United States because it is such an important market. Thus, U.S. Patent activity is representative not only of U.S. technological effort but, to a large extent, of foreign technological effort as well. For example, the growth of foreign technological capabilities in the 1960's and continuing into the 1970's has been mirrored by the growth, over the same period, of the share of the U.S. patents granted to foreign resident inventors.

This apparent interrelationship between technology and patent activity has given rise to the basic premise of the Technology Assessment and Forecast program that patent activity is an indicator and measure of technological activity both domestic and foreign. Based on this premise, the Office of Technology Assessment and Forecast (OTAF) has issued publications which have focussed on technological areas that are experiencing high levels of patenting, or in which a high proportion of the issuing patents are being granted to foreign resident inventors. (Department of Commerce Report, 1976, p. 5,6)

This effort is excellent from the standpoint of documenting and accrediting sources of new technology, but in itself is a passive rather than an active medium for technology transfer.

## D. FEDERAL LABORATORY SYSTEM

The federal laboratory system of the United States represents a vast resource of science and technology, with nearly 500 major research

and development (R&D) installations. Approximately 50,000 technology documents emanate yearly from the laboratories, many of which possess great potential for transfer of an applications of technology both within the private sector and within other areas of public respon sibility (state, county, municipal and nonprofit public agencies).

## E. DEPARTMENT OF DEFENSE LABORATORIES AND TECHNICAL CENTERS

Included in this aggregate of federal laboratories is a large number of Department of Defense (DOD) laboratories operating under the overall guidance of the Director of Defense Research and Engineering (DDR&E). The contributions of these DOD laboratories to both the generation and transfer of new technology far outside the U.S. military establishment has been phenomenal. For example, over 80 percent of all commercial jet transports operating in the free world today were designed and built in the United States. All of these jet transports have largely depended on technology or hardware derived from military sponsored programs in aeronautics. A 1972 study conducted by DOD, NASA and the Department of Transportation (DOT) identified 51 significant technological advances made in U.S. aviation during the period 1925-1972 and found that military sponsorship was responsible for 35 of them. They included everything from high octane fuel to the bypass ratio turbo fan engine which has spawned the current generation of wide body civil transports. (Currie, M.B., 1976, p. 1) Unfortunately, for every <u>one</u> technology development that has been utilized or transferred outside its original area of application, There are probably <u>ten</u> or more that have not.

In the primary text of this report, communication was identified as the single biggest need in effective technology transfer. Many avenues have been expolored to overcome this communication gap. Creighton, Jolly and Denning have applied the concept of the linker to this need. (Creighton, Jolly, et al 1972, p. 3) The linker is essentially the individual, or group of individuals, who, as the name implies, links the producer and the user. The linker is conversant with the problems, needs and environment which limit the user's perspective. He understands basically the work which the research community has on hand, or is currently pursuing. More important, he is bilingual and can translate between the scientist and the operational manager. The linker is difficult to identify. He must be of a unique frame of mind and temperament. Because of the polyglot utilized among the many diverse disciplines of science, the linker is not always capable of providing a full and accurate translation in either direction. "The linking mechanism is not necessarily additional persons or groups interposed between two systems. It is a people mechanism which can be incorporated into either the supplier or user enviornment ...." (Creighton, Jolly et al, 1972, p. 3) More basic however, is the inherent distortion in communication caused by any additional stage in the channel, even one as potentially beneficial as the linker. An alternate role for the linker is to act as a moderator in a direct dialogue among the producers of technology, the developers of technology, and the users of the products of technology.

The Navy's Civil Engineering Laboratory (CEL) has used the "linker" approach to technology transfer with apparent success. In their thesis, which evaluated the effectiveness of one research organization's

mechanism for transferring technical information to applied end use, Hendrickson and Fisher subjected the CEL operation to a cost/benefit analysis. The results of this analysis showed that the Facilities Support Engineering Office (FESO) which has utilized the "linker" approach in its operations was profitable by a benefit-to-cost ratio of over two-to-one. (Hendrickson and Fisher, 1974, p. 5)

Closely allied with the linker concept is the concept of the Champion. Several authorities (Dvorkovitz et al, appendix C) contend that no technology transfer is likely to take place unless some individual or group champions the idea. Many instances in the authors' own experience demonstrate that this view is often, if not always, true. An example is the adoption of a synthetic flame resistant hydraulic fluid for use in Navy aircraft. The fluid was developed by the Air Force for use in missile systems. A logical alternate use was in combat aircraft, where the flame resistant properties would provide significantly increased safety. The adoption took place in Navy aircraft because one of the major operational Navy staffs decided to champion the idea. No such champion came in the Air Force. To this day, Air Force aircraft still use the older, highly flammable hydraulic fluid. It may be perceived that, had the Navy champion done no more than to stop actively promoting the switchover, the program would have died within the Navy, not by virtue of any active opposition, but rather by being suffocated in a laissez-faire environment.

CEL makes use of the Champion approach by involving the inventor of a new innovation in its active promotion. Short videotaped promotional briefings are made featuring the innovator as the chief spokesman. The videotaped briefings are then distributed to potential

users of the technology. CEL has found that the interest and enthusiasm of the inventor adds more to the presentation than can be added by using a professional announcer. A secondary benefit of this program is the orientation of the innovator toward the practical utilization of his idea.

Another approach which has found particular favor with the Department of Agriculture and with NASA is the application of marketing techniques to move technology developed within these agencies into the economy. Different techniques are used by each agency. However, the general categorization of "push marketing" could be applied. The Department of Agriculture tried the sales approach, a combination of marketing and the Champion concept, by developing a force of linkers designated as Farm Agents, who visited the individual farms, bringing the results of research with them to solve the farmers' problems on a face-to-face, case-by-case, basis. NASA chose the other side of the marketing coin - advertising. Such publications as NASA's Tech Briefs, television and radio advertisements, and articles in trade and technical periodicals, carried the story of the large numbers of technological innovations that came out of the space effort, and were made available for the use of local government and private industry. NASA also developed a simplified means by which the world could beat a path to its doorstep; the computer data bank. Unfortunately however, few came. The Energy Research and Development Agency (ERDA) went one step further. Technology utilization was encouraged by the addition of developmental grants and low interest loans to those industries which chose to use new technology. Large scale public displays were set up across the country indicating the

technological developments which were available in the energy field. A whole spectrum of symposia, seminars, and workshops also have been used by almost all agencies involved in technology transfer.

## SYNOPSIS OF SYMPOSIA

### A. NATIONAL TECHNICAL INFORMATION SERVICE (NTIS)

The National Technical Information Service of the U.S. Department of Commerce is a central source for the public sale of Government-sponsored research, development and engineering reports and other analyses prepared by Federal agencies, their contractors or grantees. Also it is a central source for Federally generated machine processable data files. A major objective of the NTIS is to ensure that the vast storehouse of knowledge in its custody is available to the using communities. The first step in the process of bringing the data to the user is to ensure that potential users are aware of the existence of the material, of the NTIS, and of the NTIS role in providing access to the material. The NTIS uses as one tool in this process, the Patent Licensing Seminar, a symposium program to bring the most promising new technologies to potential users. This program was initiated about two years ago with the presentation to industry, of a new, Navy developed anti-fouling paint. The effort was judged a success because it resulted in the sale of 15 manufacturing licenses and over 100 technical data packages. The program is now on-going, with a typical symposium presenting 15-35 inventions in a related field (such as Agro-chemical) to an audience of 40 to 80 persons. The audience is drawn from the subscriber list for NTIS publications. Promotion is by direct mailings and by announcements in NTIS publications. Effectiveness is not measured directly other than by a count of the license applications which note a symposium as the place where the idea was first called to the attention of the attendee. (NTIS Report 1974)

B. ENVIRONMENTAL PROTECTION AGENCY (EPA)

The objective of the EPA Technology Transfer Program is:

> "to effectively impact the construction, installation, and operation of pollution control and abatement facilities, to insure that the latest viable technologies are transferred to potential users and eliminate the possible large investment in obsolete facilities. The program's primary function is to bridge the gap between research and full-scale use by evaluating and transferring newly developed successful technologies to consulting engineering firms; municipal industrial, and state design engineers; city managers; directors of public works; industrial managers; conservation groups; and others exerting control over the design and construction of all pollution control and abatement facilities. A further goal is to firmly establish the newly emerging technologies as practical and feasible alternatives on a national basis, to be routinely considered and evaluated in the planning of these facilities." (EPA Brochure GPO 797-249).

To implement this objective, a series of seminars is conducted throughout the United States to present detailed information on the latest pollution control technologies and practicies. One aim of these seminars is to make the small manufacturer aware of the alternative proven technologies available to him. Seminar presentations are jointly conducted by EPA personnel, consulting engineers, and appropriate equipment manufacturers and industries. Seminars are publicized by the direct mailing of announcements to interested individuals contained on a master mailing list which was formulated by the EPA. The list contains approximately 55,000 names indexed by areas of interest and geographical location. Effectiveness is judged primarily by viewing the results in the new plants wich are being built.

C. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA's Technology Utilization Office has, since the inception of the NASA program, been charged with the effective utilization of the new technology and other technical information generated by the space program. NASA has used the technical symposium as a means of developing awareness

of the NASA program among potential users of their technology. The symposia are designed to give examples of the technology that is available in particular technical subject areas, and to indicate the method by which the user can gain access to this data through NASA's Tech Briefs and computerized technical data bank. The symposium format is adapted, as well as possible, to meet the audience's desires and expectations. Pre-symposium response cards are used to indicate audience orientation and interests. Each symposium has a wrap-up discussion between participants and the audience to determine if the expectations of the audience have been met, and to determine what changes in format might have been made to make the symposium more effective. NASA uses the numbers of patent licenses applied for by new industries as a measure of its effectiveness in transferring technology. (NASA Appendix B)

D. DVORKOVITZ AND ASSOCIATES

Dvorkovitz and Associates sponsors the World's Fair for Technology Exchange. Dvorkovitz and Associates describe their function as "searching for and licensing technology .... finding those who have new products, processes or uses which they are willing to license, finding those who are interested in utilizing the technology in question, and bringing the parties together." (UNIT, 1976, p. 51) The World's Fair is organized to bring users into contact with innovators. A series of booths is used to present the technologies to attendees. Also scheduled are a series of technical presentations encompassing some technologies available in specific fields. Dvorkovitz maintains a data bank of technology available for licensing, and of technological needs submitted

by subscribers to his service. Promotion is accomplished through field representatives, word-of-mouth, media publicity, and UNIT (Dvorkovitz's monthly publication on technology, etc.). Effectiveness is measured by observation at the Fair, by informal comments received, by testimonials, by the number of computer searches originated, and (mostly) by licensing agreements established. (Dvorkovitz, Appendix B)

E. JET PROPULSION LABORATORY (JPL)

JPL is an agency of the California Institute of Technology, and is under contract to NASA to help bring space technology to the small business community, particularly in minority areas. JPL uses the "mini-symposia" or short, concise one-half day meetings with small groups of company executives interested in a common aspect of technology. The technology involved is aimed at the small business, and as such, is oriented toward low investment technologies. JPL makes a particular effort to tailor the presentation toward the audience, particularly in terms of language and technical content. JPL develops a pre-symposium discourse between the presenter and the intended audience in order to determine common interest areas. No direct effectiveness measurement system is established. (JPL, Appendix B)

F. THE NAVAL POSTGRADUATE SCHOOL (NPS)

The Naval Postgraduate School has held a number of technical symposia with the intention of bringing together representatives of government, industry, and research organizations to discuss research and development within a specific technical segment of the R&D community. Such a symposium was the recent (June 22-24 1976) Air Data Symposium jointly sponsored by Naval Air Development Center (NADC) and Naval Air Systems

Command (NAVAIRSYSCOM). Its aim was to provide an opportunity for the members of the air data community to discuss air data requirements, techniques, accomplishments, applications, problems and new technology. "It also provides for the vital exchange of technical information necessary to meet the performance requirements of the newest military aircraft." (Commerce Business Daily, June 10, 1976). In this case a major effort was made to involve all members of the community from researchers and airframe manufacturer to aircraft performance evaluation activities. The audience was invited primarily through community contacts and word of mouth. Evaluation was accomplished by the use of post-symposium critique sheets. Little effort was made to integrate all segments of the technology utilization chain, resulting to a large extent, in preaching only to the choir.

The NPS has held one symposium directed specifically at the discipline of technology transfer. Interestingly, even this symposium included only the technology transfer agents, and made no attempt to integrate users in the symposium. A group of technology transfer agents presented their particular technology transfer programs to an audience which for the most part, was probably well aware of them before hand. No system was set up to measure effectiveness, however, the response received from the audience has led the organizers of this symposium to believe that it was very worth while.

G. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)

Working under a grant from the National Commission on Productivity and Work Quality, the Massachusetts Institute of Technology directed an experimental program entitled Technology Applied to the Food Industry

(TAFI). One phase of this program was a symposium on the problems of the food industry which might be alleviated by the application of advanced technology. The impetus for this study was the relative decline in productivity among workers in the food industry. An interesting approach was taken in this symposium in that the user groups were asked to present their problems to an assemblage of technologists. This presentation led to a round-table discussion of these problems and how technologies in existence could be brought to bear in solving them. One of the major reasons that the available technology had not been used to address the users' problems was determined to be a lack of communications between the producers of the equipment and the industry that they were attempting to serve. One result of the symposium was a compilation of current problems which troubled the food marketing industry. This list was made available to the industry as an instrument for directing its research effort. A questionnaire was used to survey the audience and participants before the symposium, to determine their interests and backgrounds. This information was used to assist in identifying mutual interests between symposium participants and their audience. No effort was made to gather data on the symposium's effectiveness, however many favorable testimonials were received by the study group. (Bloom, 1975)

In addition to the foregoing descriptions of current technology transfer activity, many technical societies have formed Technology Transfer subcommittees for the purpose of filling the linker role for the new technologies which might affect their particular disciplines.

A new technical society has come forth dedicated totally to the discipline of technology transfer. The first Annual Meeting and International Symposium of the Technology Transfer Society* was held in Los Angeles on 25 June 1976. The goals of this society, as set forth in the Articles of Incorporation, are to:

1. Encourage development of technology assessement, transfer, utilization, and forecasting techniques, and otherwise advance the state-of-the-art, thereby aiding development of the general community.

2. Disseminate information on new techniques in technology assessment, transfer, utilization and forecasting disciplines.

3. Establish standards, ethics and define terms for the technology assessment, transfer, utilization and forecasting disciplines.

4. Provide liaison between and among the disciplines of the technological community such as science, management, engineering, information services and education, and with other professional societies.

5. Provide a non-profit capability to accept grants and contracts for the performance of pilot technological programs which will aid the general community.

6. Develop an environment for and promote the enhancement of professional competence in general fields of technology assessment, transfer, utilization and forecasting.

Another reasonably effective way of bringing the new technologies to the public's notice is through the use of popular literature such as Popular Science, Popular Mechanics, et al. Two technological developments which promise significant benefit to the Navy were uncovered by an engineer at Naval Air Rework Facility (NARF), North Island, California, while reading such literature. The publications were just reporting the technology that someone else had developed, and the individual involved

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1 Technology Transfer Society, P.O. Box 7178, Los Angeles, California 90022.

had the imagination to see how the products could be used on Navy aircraft. These publications have the advantage of very large circulation, and the virtue of having the presentation geared to understanding by someone outside the field of the invention.

In retrospect, there is great interest in technology transfer, and much effort is being expended to cause technology transfer to happen. These efforts have met with some success. Certainly a look at the world of today reveals that a wealth of technology available to use has been, to some extent, used to benefit society. However, most knowlegeable experts in the field feel that it has not been nearly as effective as it could be. Little progress seems to have been made to develop a pull market. In almost all cases, the effort has been to present the technology to the potential user and to let him use the aspects that appear to him as having beneficial potential. Energy Research and Development Administration (ERDA), Environmental Protection Agency (EPA), and some other agencies who have an effect on regulatory and legislative restrictions have had the most success by virtue of being able to require the use of new technology.

The recognition that ideas must be marketed just as soap and potato chips is a major concept in effective technology transfer. Efforts to date have concentrated on filling the grocers' shelves with ideas, and developing deluxe automated check out stands. Not much effort has been expended in making the shopper want to come into the store. The idea that the individual shopper's needs might be met by the products on the shelf has not been effectively communicated. Until it is, no amount of pushing the product into the market will produce a major effect.

APPENDIX B

INTERVIEW FORM

Name: Mr. Jim Smith Date: July 6, 1976

Organization: Environmental Protection Agency

Location: Cincinnati, Ohio Phone: 513-684-4404

Question: Please describe the symposium program utilized by the Environmental Protection Agency in their Technology Transfer effort.

Reply: Mr. Smith works for the technology utilization section of the Environmental Protection Agency. Their effort started several years back with the realization that many technological innovations in the area of water quality were not being incorporated into new water treatment plant designs. A series of presentations were developed to show these new technologies to potential designers of new plants. This audience was derived from an EPA developed mailing list of approximately 55,000 names, primarily of policy makers, legistlative agencies, and consulting engineers. Format is developed on an ad hoc basis to suit the audience and the subject. Many symposia are repeated a number of times to regional audiences, however, some seminars are aimed at a national audience and draw as many as 600 to 700 people. As experience was gained with the symposium approach it was found that narrower topics, aimed toward more selective audiences appeared to provide

greater benefits. A typical symposium topic might be "Advances in the removal of Nitrogen Compunds from Processed Sewage."

Question: How is the effectiveness of the symposium approach judged?

Reply: Effectiveness is judged primarily by observing the number of new technological innovations which are incorporated in plants. In some cases, the design agency incorporates the design to provide a greater capability; in some cases the procuring agency upgrades their specifications as a result of the knowledge that they gain through the symposium program. A number of testimonials have been received which reflect favorably on the symposium program, and which have offered many useful suggestions on how the program could be improved. Periodic questionnaires have been used to judge audience response. These, too, have provided many improvements in the format of the presentation.

Question: What format is used in the presentation phase of the symposium?

Reply: A very standard form is used. Presentations are grouped to interest area, and the presentation is made, whenever possible, by someone directly involved with the development of the idea being presented. No user presentations have ever been tried.

## INTERVIEW FORM

Phone Interview Date: 12 July 1976

Name: Mr. Hernandez Phone: 213-746-2434

Organization: University of Southern California, 400 Hoffman Hall, Los Angeles, California 90007

Regarding the University of Southern California Food Users Symposium.

Mr. Hernandez works with the TAFI at the University of Southern California (USC). He and two other persons had a contract from the Federal Government to conduct a Technology Applied to the Food Industry (TAFI) Symposium. The contract was for $15,000 for six months.

The symposium was conducted in 1975. The results were documented.

The effort involved first contacting technology users in the food industry and high technical producers and mailing out over 10,000 brochures. The high technical companies response was low (30 to 75 companies, 100 people attended). Those that did respond were very enthusiastic individuals.

Technology needs were compiled and verified by a panel of users. The panel then presented the results: (1) How methods are currently done; and (2) How it is desired (through new technology) to be done in the future.

The results were documented - no attempt was made to measure the effectiveness of the symposium. Contract and time frame did not provide for follow-on work.

Mr. Hernandez views technology as a very slow process with numerous advertisements and technical libraries. He feels the users must get involved early in the process for any significant technology to evolve.

INTERVIEW FORM

Telephone Interview Dates: 6 and 10 July 1976

Name: Dr. Laurie Broedling, Research Psychologist

Organization: Navy Personnel Research and Development Center (NPRDC)

Phone: 933-2191 (Autovon)

Question: What means of measuring the effectiveness would you use to evaluate technology transfer via a symposium approach?

Reply: Dr. Broedling stated that technology was basically a special case of the utilization of knowledge and advised that significant work had been done by the Institute for Social Research at the University of Michigan. She recommended speaking to a Dr. Al Sjoholm (at NPRDC) on this subject as he had made extensive studies in this area.

Dr. Broedling then pointed out that in her opinion, the most effective method of presenting technology through the medium of a symposium could best be determined experimentally by evaluating various formats. The use of a single method of evaluation, or concentration of any single indicator was considered to be suboptimal as this had a tendency to indicate the varying sensitivities of the method rather than actually indicating trends. Therefore, the use of a multi-trait, multi-method measuring system was recommended. A matrix model could

then be established representing changes in various traits represented by the different measurement techniques used.

A review of the sub-goals of a Technology Symposium indicated that traits which would be effected were: Knowledge, awareness, effectiveness, attitude, behavior, and values.

Dr. Broedling recommended an article on physchological multi-trait measurement by Campbell and Fiske and a work entitled, "Psychological Measurement" by Campbell and Stanley. She also offered to forward a copy of a paper on the H.E.L.P. Score Model for measuring trait relationships.

INTERVIEW FORM

Telephone Interview Date: 6 July 1976

Name: Mr. Campenton

Organization: National Technical Information Service (NTIS), Washington, D.C. Phone: 703-321-8530

Question: What is Mr. Campenton's position in NTIS, and how does NTIS use the symposium as a technology transfer instrument?

Reply: Mr. Campenton works with Mr. Kuoravetz in organizing and presenting the NTIS Invention Seminar Program which presents promising technical developments to interested utilizers of technology through a system of seminars. This program was initiated approximately two years ago with the presentation to industry of a marine anti-fouling paint developed by the Navy. The effort was judged a success, resulting in 15 licenses and some 700 technical data packages. Since that time the seminars have developed to where they now cover a technical sub-discipline area, presenting 15 to 35 of the most promising inventions in the particular area. Attendance is normally 40 to 80 persons. Promotion is developed primarily through direct mailings and notices in NTIS periodic publications. The contacts are derived from the NTIS subscribers list of some 30,000 subscribers. Promotion is normally restricted to those subscribers evidencing interest in the particular area being

analyzed. Approximately one month's advance notice is given to provide adequate time for travel arrangements to be made.

Question: How is the technology presented in the seminar?

Reply: Presentations are normally made by the inventor, or or someone technically close to the invention. Presentations concentrate on applications rather than technical aspects. Preparations for a seminar are normally initiated three to four months in advance.

Question: How is seminar effectiveness measured?

Reply: The effectiveness is determined largely by counting the numbers of licenses resulting from a seminar. While this method is not foolproof, it is considered a reasonable proxy. Many "transfers" are missed, though, by this method. The tabulation requires notation on the licensing application under the question, "Where did you first hear of this technology?" Also many technologies are not directly licensable. In the case of the anti-fouling paint, previous publication of some of the data made foreign patenting impossible. Still technology was transferred to one Japanese firm by the sale of a "know-how data package". Other feedback is obtained through testimonials and random questionnaires.

Due to the heavy workload at NTIS and the growing scope of the effort, NTIS is considering contracting the seminar program to an outside technology transfer agent.

(NOTE: NTIS has contracted with Public Technology Incorporated, a semi-private technology transfer agency, to conduct some seminar programs.)

INTERVIEW FORM

Name: Ray Gilbert Date: July 15, 1976

Organization: National Aeronautics and Space Administration

Location: Washington, D. C. Phone: 775-3140

Question: Please describe the symposium program utilized by the National Aeronautics and Space Administration in their technology transfer effort.

Reply: Mr. Gilbert works in the Technology Utilization Office of NASA. Mr. Gilbert stated that, from the beginning, NASA had had the goal of finding secondary utilization of the technologies they developed. NASA recognized that the large volumes of technical information generated by space research represent a valuable national resource for industry. The National Aeronautics and Space Act of 1958 provided for the technology transfer effort. NASA has extensive data cataloging and retrieval systems developed to find the technology available on any given subject. The symposium program was developed primarily to build awareness of this capability. Several symposia have been run in conjunction with the Small Business Administration. The most effective symposia have been preceded by an effort to identify the audience and their interests. Mr. Gilbert felt this to be a critical part of the preparation of a successful symposium. This data was normally obtained by use of a response card questioning interest and expectations. Mr. Gilbert also felt that

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patent representation was necessary at the symposium to answer the many questions on this subject which normally came up in any discussion. NASA does have funds to develop a functional prototype of a technological innovation which is to be developed for the public domain. This is an added inducement to producers of goods in these areas. Mr. Gilbert indicated that private companies, increasingly, are marketing the spinoff results of their own research efforts. General Electric was mentioned as being particularly active in this area.

Question: How is the effectiveness of your symposium effort judged?

Reply: The measurement of effectiveness is a very difficult matter, particularly bearing in mind that the ultimate purpose of the symposium program is to introduce the user to other access routes to NASA technology. A very valuable technique developed to evaluate the individual symposium, is wrap-up discussion, where the participants and audience discuss how the expectations and needs of the audience might have been better met.

## INTERVIEW FORM

Name: Len Sauer Date: 15 July 1976

Organization: Jet Propulsion Laboratory

Location: Los Angeles, California Phone: 354-2240

Question: Please describe the symposium program utilized by the Jet Propulsion Laboratory in their Technology Transfer Effort.

Reply: Mr. Sauer states that JPL uses what he terms Mini-symposia, a short, concise one half day meeting among a small group of company executives interested in a common aspect of technology. Two such symposia had been conducted. The technology involved is aimed at the small business, and as such, is oriented toward low investment technologies. A particular effort is made to direct the presentation toward the managers of a small company, particularly in terms of language and technical content. The method utilizes initial discourse between the presenter and the intended audience in order to find common interest areas. Investment in the symposium is small, averaging not much more than one-man month to organize and present.

Question: How was the effectiveness of the symposium judged?

Reply: Not enough time has elapsed to make any direct measurements of the effectiveness. A number of letters, very favorable to the program have been received.

## INTERVIEW FORM

| | | | |
|---|---|---|---|
| Name: | LTjg Carl Heck | Date: | 15 July 1976 |
| Organization: | Naval Communication Station, Stockton | | |
| Location: | Stockton, California | Phone: | 730-1500, Ext 223 (Autovon) |

Question: Do you feel that a symposium approach to bring the needs of the using activities to the attention of research and procurement activities would be of any value, and, if so, would NAVCOMSTA be interested in participating in a symposium on the general topic area of Communications Electronics?

Reply: The idea sounds feasible and could be very valuable. Mr. Heck personally felt that participation by NAVCOMSTA would be valuable, but that any decision would have to be made by higher authority. Mr. Heck did feel that there was a communications gap between the user and the procurement sections of the Navy. Mr. Heck is the Maintenance Officer of the NAVCOMSTA electronic equipment.

INTERVIEW FORM

Name: Dr. Sjoholm Date: 15 July 1976

Organization: Navy Personnel Research Center

Location: San Diego, California Phone: 933-7424 (Autovon)

Question: What is your role and the role of the Navy Personnel Research Center in the Navy Techology Transfer Program?

Reply: The Naval Personnel Research Center is the lead laboratory and the central contact point for the Navy's Human Resources Program. Dr. Sjoholm works in the area of utilization of the technology developed in this area. The Naval Personnel Research Center uses a team approach to brief other commands on the benefits available through the program. Dr. Sjoholm considers that technology transfer must be considered in the research from the beginning and that the Naval Personnel Research Center uses this consideration in its research. The Naval Personnel Research Center is currently developing an economic impact model to enable it to better demonstrate the economic benefits of its technology transfer program.

INTERVIEW FORM

Name: Jack Lang Date: 8 July 1976

Organization: Small Business Administration, Technology Assistance Division. President Elect of Technology Transfer Society

Phone: 213-688-2956

Question: Please describe the role of the Small Business Administration (SBA) in Technology Transfer.

Reply: The SBA started the symposium/work shop approach to Technology Transfer in 1968, working in conjunction with NASA, and Western Research Advisory Committee (WESRAC) (a part of the University of Southern California working on Technology Transfer under NASA funding). Early experience showed that presentations had to be directed toward technology utilization rather than technical detail. Even so, early efforts were shown to be quite effective based on a questionnaire survey of attendees. Refinements included the use of a marketing apprach to seminar promotions, involvement of technical societies as co-sponsors and advisors, and matching presentation techniques to the perceived audience background. For certain audiences, this involved a review of the general technology before presenting the detailed innovations.

Distribution of announcements was made at least 90 days prior to the scheduled date so that technical

media could "carry the word". Distribution was to industries by Standard Industrial Classification (S.I.C.) industry codes.

Evaluation was accomplished by post-seminar questionnaires. Results indicated that the technology offered at times did not match the needs of small business. No pre-survey work was done to determine the suitability of the potential symposium topics, nor was any formal user participation encouraged beyond questions from the floor.

The organization and implementation of a symposium was judged to require at least one-half man-years of effort by the sponsor.

The SBA has found that individual mailings of potential technological advances followed by personal follow-up was also an effective means of transferring technology. This technique has been used to replace the symposium approach.

Mr. Lang recommended that any symposium effort be coordinated with related technical societies, and that the project be approached with a detailed, written list of expectations. Evaluation was recommended to be by questionnaire immediately after the symposium, with a follow-up three to six months afterward.

INTERVIEW FORM

Name: Professor Schmidt Date: 20 July 1976

Organization: Naval Postgraduate School Phone: 408-372-3084

Question: Please describe the purpose and format of the Air Data Technical Symposium held at the Naval Postgraduate School (NPG) on 22 June 1976.

Reply: The major purpose of the symposium was to bring together members of the air data community for an interchange of technical information on new developments, research on-going, and problems in the field. The symposium was jointly sponsored by NADC Johnsville, Naval Air Systems, and NPS. The schedule lasted three full days and included six sessions and twenty-four presentations. All three services, the Navy, Army, and Air Force participated. Approximately 150 people attended.

Question: How did you identify your audience?

Reply: By old contacts, and by the contacts of NAVAIR and NADC. Mostly word-of-mouth, but the word really gets around.

Question: How did you measure the effectiveness of the symposium?

Reply: Critique sheets were filled out at the end of the symposium. As yet these have not been fully evaluated. Some feedback will also be received when the proceedings are published.

INTERVIEW FORM

Personal/Phone Interview

Period: 4 June 1976 through 6 July 1976

Name: Mr. John Kristof and Dr. Birch

Organization: DDR&E Director of Telecommunications

Phone: 227-3125 (Autovon)

(The following is derived from a series of conversations between two of the authors and Messrs Kristof and Birch over the period noted.)

The DDR&E Office is in full accord with the transfer of technology among users, innovators, and the academic establishment. Their interest lies primarily with the development of more advanced telecommunication systems for the Department of Defense. They believe that an exchange of needs, ideas, capabilities, and previous efforts between all participants in the proposed telecommunications symposiums can produce mutually beneficial results and stand ready to aid such an effort in any way they can. Dr. Birch was provided with a compilation of Naval Postgraduate School telecommunication theses which were judged to have particularly good transfer capability. He reviewed this list, providing some areas of interest, and other areas of possible investigation.

Both Dr. Birch and Mr. Kristof expressed caution as to the amount of funding support which the Department of Defense could offer to the Naval Postgraduate School for thesis research, however, he did indicate that some support funding (travel, per diem, etc.) could be made available for worthwhile projects.

APPENDIX C

## TECHNOLOGY TRANSFER SYMPOSIUM PRE-SURVEY QUESTIONNAIRE

Please assist us in our symposium Effectiveness Measurement Program by completing this questionnaire prior to commencement of the meeting. Enclose completed form in the envelope provided and drop in the return box located at the conference room entry. Your cooperation is appreciated. Replies will be kept confidential.

1. Name and Title Telephone Number:

   Name of Organization

   Address

   City State Zip Code

2. Do you feel this symposium was properly advertised?

   Yes_____ No _____

3. What most directly triggered your attendance?

   a. Mailed announcement _____

   b. Newspaper notice _____

   c. Radio announcement _____

   d. Telephone call _____

   e. Talking to friends _____

   f. Other _____

4. How much advance notice did you have concerning this symposium?

   a. Less than one month _____

   b. Between one and two months _____

   c. Between two and three months _____

   D. More than three months _____

TECHNOLOGY TRANSFER SYMPOSIUM PRE-SURVEY QUESTIONNAIRE (Continued)

5. Are you planning to attend each day of the symposium?

   Yes _____ No _____

6. Are you commuting? Yes _____ No _____

7. Which of the following best describes your present situation?

   a. Technology supplier (innovator, inventory, etc.) _____

   b. Technology user _____

   c. Technology transfer agent _____

   d. Other _____

8. What subject(s) are you most interested in? _____

9. Do you own or have knowledge of technology that you feel should be transferred? Yes _____ No _____

10. Do you have a technical problem that requires new technology?

    Yes _____ No _____

11. What do you hope to gain from this symposium?

12. Are you scheduled to speak or participate in this symposium?

    Yes _____ No _____

13. Has your organization benefited in a direct way from a technology transfer effort within the past year?

    Yes _____ No _____ Not Sure _____

14. Do you consider yourself familiar with the basic concepts and terminology of technology transfer?

    Yes _____ No _____ Not Sure _____

TECHNOLOGY TRANSFER SYMPOSIUM PRE-SURVEY QUESTIONNAIRE (Continued)

15. Are you aware of the major barriers to technology transfer?

    Yes _____ No _____ Not Sure _____

16. Which barrier do you feel impedes technology transfer the most?

17. Do you feel that the vacuum of technological need is sufficient to cause the flow of technology?

    Yes _____ No _____ Not Sure _____

18. Do you feel that the resources used by the research organization to transfer technology might provide greater gains if it were reinvested into the research effort?

    Yes _____ No _____ Not Sure _____

19. How many formal group meetings relevant to technology transfer have you attended in the past year?

    a. None _____

    b. One _____

    c. Two _____

    d. Three _____

    e. Four or more _____

20. Do you feel you understand the goals established for this symposium?

    Yes _____ No _____ Not Sure _____

## TECHNOLOGY TRANSFER SYMPOSIUM POST-SURVEY QUESTIONNAIRE

We welcome your opinions to the symposium just concluded on (Subject) _____ held from (starting date to ending date). Your reactions will assist us in measuring the effectiveness of the symposium and guide us in improving such symposia in the future. Replies will be kept confidential.

1. Name and Title

   Name of Organization

   Telephone Number

   Address

   City State Zip Code

2. Was the symposium worth your time and money?

   Yes _____ No _____ Barely _____ Not Sure _____

3. How do you feel that the symposium could have been more effectively organized?

4. What benefits did you receive from the symposium? Were any of these unexpected?

5. Did you receive from the symposium:

   a. More than expected _____?

   b. Just what you expected _____?

   c. Less than you expected _____?

TECHNOLOGY TRANSFER SYMPOSIUM POST-SURVEY QUESTIONNAIRE (Continued)

6. List in the order of their importance to you the three most important things you learned:

   a.

   b.

   c.

7. Do you feel that a specific effort by the research organization is necessary to cause the technology it develops to be utilized?

   Yes _____ No _____ Not Sure _____

8. Do you feel that the vacuum of technological need is sufficient to cause the flow of technology?

   Yes _____ No _____ Not Sure _____

9. How do you feel your organization fits into the use of the technology discussed in the symposium?

10. Can you roughly estimate the value of this symposium to your organization for the next year, in dollars? _____.

11. What uses, if any, do you plan to make of the knowledge you have gained from the symposium? _____.

12. What number of contacts did you make at this symposium? _____.

13. What do you feel was the most effective technique used in the symposium?

14. Would you attend a similar symposium in the future on a different subject in your area of interest?

    Yes _____ No. _____ Not Sure _____

POST-SURVEY QUESTIONNAIRE (CONTINUED)

Please check the column you feel is more nearly correct. Use the back side to expand on any thoughts you wish to express.

| | NA[1] | EXC[2] | GOOD | FAIR | POOR |
|---|---|---|---|---|---|
| SYMPOSIUM | | | | | |
| Quality of planning | | | | | |
| Advertising media | | | | | |
| Advertising information | | | | | |
| Length of Symposium | | | | | |
| Agenda | | | | | |
| Achievement of stated goals | | | | | |
| Seating arrangements | | | | | |
| Presentation methods | | | | | |
| Speakers' quality (in general) | | | | | |
| Speakers' preparation | | | | | |
| Speaker's choice of words | | | | | |
| Could hear what was said | | | | | |
| Could see what was going on | | | | | |
| Could understand terminology. | | | | | |
| My interest in subject matter | | | | | |
| Usefulness of information to me | | | | | |
| Meeting room in general | | | | | |

NOTE:

[1] NA = No opinion or chance to observe

[2] EXC = Excellent

POST-SURVEY QUESTIONNAIRE (CONTINUED)

| | NA[1] | EXC[2] | GOOD | FAIR | POOR |
|---|---|---|---|---|---|
| Size of room, conference | | | | | |
| Furniture and fixtures | | | | | |
| Temperature control | | | | | |
| Ventilation | | | | | |
| Quality of equipment | | | | | |
| Restrooms accommodations | | | | | |
| LODGING | | | | | |
| Rooms | | | | | |
| Food | | | | | |
| Recreation | | | | | |
| Management | | | | | |
| Pricing | | | | | |
| My recommendations of this location for future meetings | | | | | |

NOTE:

[1] NA = No opinion or change to observe

[2] EXC = Excellent

TECHNOLOGY TRANSFER SYMPOSIUM FOLLOW-UP QUESTIONNAIRE

Dear Mr. _____

From (starting date) to (ending date) you attended a symposium on (subject) at (location). In order to complete our effectiveness measurement of this symposium, it would be extremely valuable if you would fill in this questionnaire and return it in the attached self-addressed envelope.

1. Are you still with the same organization? Yes_____ No _____.
2. Are you now using information received at the symposium in your operations as a result (direct or indirect) of your attending the symposium? Yes _____ No _____ Not Sure _____
3. Has the symposium information enabled you to:
   a. Improve on performance of present work? Yes _____ No _____
   b. Cut costs on work you perform? Yes _____ No _____
   c. Increase your capability? Yes _____ No._____
   d. Increase workload? Yes _____ No _____
   e. Develop new products for your organization? Yes _____ No _____
4. Can you give specific examples as to the use you made of the symposium information?

5. Can you roughly estimate in dollars the value to your organization of the symposium information received:
   a. Since attending the symposium? _____
   b. For the next year? _____
   c. Cannot make estimate, but of some value _____
   d. Information of no tangible value _____

TECHNOLOGY TRANSFER SYMPOSIUM FOLLOW-UP QUESTIONNAIRE (CONTINUED)

6. Was the symposium worth your time and money? Yes _____ No _____

7. Would you attend a similar symposium in the future on a different subject in your area of interest? Yes _____ No _____ Not Sure ____

8. Please given any thoughts or comments on you to improve this type symposium or on the transfer of technology. (Use reverse side if necessary.)

9. Of these people you met at the symposium what percentage have you subsequently contacted? _____

10. Do you feel that a specific effort is necessary by the research organization to cause the technology it develops to be utilized?
Yes _____ No _____ Not Sure _____

11. Do you feel that the resources used by the research organization to to transfer technology might provide greater gains if it were reinvested into the research effort?
Yes _____ No _____ Not Sure _____

APPENDIX D

## PROPOSED CNO INSTRUCTION

From: Chief of Naval Operations

To: Distribution List

Subj: Navy Technology Transfer Symposium Program; establishment of

Ref: (a) SECNAVINST 5700.14
(b) Naval Post Graduate School Thesis NPS-54CF76095, " A Study of the Effectiveness of Symposia for Transferring Technical Information to Applied End Use"
(c) Public Law 94-282, National Science, Technology, and Priorities Act of 1976

Encl: (1) Navy Technology Transfer Symposium Program

1. Purpose: To set forth the policy and procedures to be utilized in establishing a symposium program within the Navy for the transfer of technology developed in the Navy to non-Navy users, and to other labs within the Navy.

2. Cancellation: None.

3. Policy: It is the policy of the Chief of Naval Operations that technological advances developed in the Navy research program must, to the maximum extent possible consistent with defense security limitations, be made available for the benefit of Department of Defense (DOD) and society at large. Consistent with the policy, copies of all technical reports are made available to state, local, and private interests, through the facilities of the National Technical Information Service (NTIS); however, experience has shown that a general knowledge of the availability of this data does not exist, nor is there an appreciation among potential users of the range and depth of the material available.

Therefore, it is the intent of the Chief of Naval Operations to establish a series of symposia to bring technology developed by the Navy into the hands of other technology developing and using organizations.

4. Background: During the past years, the Navy has expended millions of dollars to develop the scientific and technical expertise required to carry out its mission. In addition, large professional staffs have been developed in the Navy lab structure, capable of solving complex problems facing not only the Navy but American society as a whole. These vast investments and resources can realize their greatest effectiveness if they are utilized effectively in all sectors; federal, state, local, and private industry. Experience has shown that, on the average, one dollar spent on research has the potential of returning over ten dollars in Gross National Product, but only if the products of research are effectively developed into useful products. Unfortunately, much research is tucked away, perhaps never to provide benefit to anyone. To ensure that this problem is minimized in the Navy, and that the maximum benefit is received from every research dollar, the symposium program set forth in this directive has been developed. It represents a first step in strengthening the Navy's technology transfer program established by reference (a).

5. Action: The Chief, Naval Material, in conjunction with the Naval Post Graduate School, will develop a Technology Transfer Symposium Program in accordance with the guidelines set forth in enclosure (1). The program will commence not later than 31 December 1976, and will proceed at a rate of not less than one technical symposium each three months.

## NAVY TECHNOLOGY TRANSFER SYMPOSIUM PROGRAM

1. A large inventory of technological innovation exists in the laboratories and research establishments of the Navy. To obtain maximum effectivness from this technology, it is essential that it be applied to as many applications as may be found for it within the limits of the laws of economics. To facilitate the dissemination of this technology to all potential users, the Chief of Naval Material (CNM) will sponsor a continuing series of technical symposia for the purpose of bringing together the creators of technology, presenting their most promising new technologies and their capabilities for future developments; with private sector producers and Department of Defense (DOD) and federal developmental activities, presenting their perceived needs, production limitations, and other developmental problem areas; and end users, such as Fleet units, staff technicians, and other government agencies. The purpose will be to present the problems that they are experiencing which seem amenable to technical solutions.

2. As a result of the high level of expertise in the field of technology transfer which has been developed at the Naval Post Graduate School (NPS), the NPS will act as agent for the CNM in organizing and presenting this symposium series. This action will continue until the optimum format for presenting the program has been developed. Following this point, organizational and presentation responsibilities will be assumed by the CNM.

Enclosure (1)

3. A maximum effort will be made to coordinate the symposium program thus established with similar programs underway within the Department of Transportation (DOT), the Department of Commerce, and the Energy Research and Development Administration (ERDA).

## PROPOSED CNM INSTRUCTION

From: Chief of Naval Material

To: Distribution List

Subj: Navy Technology Transfer Symposium Program; establishment of

Ref: (a) CNO INST
(b) SECNAVINST 5700.14
(c) Naval Post Graduate School Thesis NPS-54CF76095, " A Study of the Effectiveness of Symposia for Transferring Technical Information to Applied End Use"

1. Purpose: To set forth the procedures and policy, established by reference (a) for the Navy Technology Transfer Symposium Program.

2. Cancellation: None.

3. Discussion: The Navy research effort has developed a vast quantity of modern technology, capable of development into technological solutions for many of the problems of activities outside the Navy. While much of this technology reaches other government agencies and the private sector over a period of time, the delays which result from transfer by diffusion can be extremely costly in terms of lost opportunities and unresolved problems. For this reason, the Chief of Naval Operations (CNO) has directed, by reference (a), that the Chief of Naval Material (CNM) take the lead in developing a technology transfer program using series of symposia to disseminate the results of Navy research efforts to potential using activities. It is considered that, in addition to the societal benefit which will result from such a program, that it will result in significant benefits to the Navy in terms of increased R&D funding, greater public confidence, and a more consumer oriented point of view in the research effort.

4. Action:

a. The Naval Post Graduate School (NPS), acting for the CNM, will establish, organize, and present a series of symposia designed to bring the results of Navy research to potential using activities, and to bring the problems and needs which confront the using activities to the atention of the research organizations so that a mutual program can be developed to bring the benefits of technological innovation to bear on existing areas of need. Included in the resources of technology brought forth in this symposium program will be the thesis efforts on file at the NPS. Symposia should be restricted to narrow enough technical areas that ample coverage can be given to the major aspects of the individual area. However, enough scope must be maintained in each symposium to allow for a broad view of the problem.

b. All Naval activities are requested to provide the maximum support to the Navy Technology Transfer Symposium Program. This is to include technical advice on what topics should be covered, participation in symposia which cover areas of technical significance to the mission of the activity involved, and to act as hosts for symposia directly related to the primary task of the activity.

c. Navy research activities will, upon request by the NPS, review the technical agenda for proposed symposia, and provide comments on how both content and format might be improved.

d. The Director for Technology Utilization in CNM (MAT 03T) will act as overall program manager for the symposium program and will provide direction for any unresolved areas of this program.

APPENDIX E

## OBSERVER GROUP GUIDELINES

In Chapter VII it was stated that the benefits that an individual might gain from a symposium would be reflected in changes in the several traits of the individual. These traits include understanding, appreciation, critical thinking, knowledge, awareness, and values. Several symposium techniques were developed to influence these traits. These included presentation techniques, individual integration into the symposium environment, question and answer periods, event scheduling, topical relevance, social integration of the individual, and presentations of all areas of the technology utilization chain.

*Observer groups are to be formed* as one means of evaluating the effectiveness of these actions. The group should be formed from four to six members of the total audience (including presenters). As much diversification of background as possible among individual members of the group should be developed by selective assignment. Each group, during the course of the symposium, would observe one particular aspect of the symposium to determine how well that particular aspect achieved the end which the group perceived it to be attempting to accomplish. As an example, suppose group A were assigned the responsibility to monitor symposium format. Initially the group would be briefed regarding the importance of effectiveness measurement and the purpose for which their contributions were being sought. Their perceived general goals and objectives of the symposium would be reviewed among themselves, the role of symposium format would be examined to determine what it should seek to accomplish in support of the general goals, and how it

should be arranged to accomplish these goals. During the course of the meeting, group A would continuously review the following questions among themselves:

1. What is the purpose of this symposium?
2. What is the role of format in achieving this purpose?
3. How well is the format fulfilling its role?
4. How might it be improved?
5. How well is the symposium meeting the expectations of the individual group members?

During this last session, each group would present the answers to the question it examined, and then be open to questions from other attendees. A unified reply would not be necessary, for the diversities of opinion within the group might provide an index as to the reliability of the measurement.

APPENDIX F

Statement of Work

NAVAL MATERIAL COMMAND MODEL TECHNOLOGY TRANSFER SYMPOSIUM

A. PURPOSE

Plan, execute and evaluate a model Technology Transfer Symposium in the technical area of Communications Electronics for the Naval Material Command (Code MAT 03T)

B. METHOD

Assign to the Naval Postgraduate School (NPS) Monterey, California the responsibility for the planning, execution and evaluation of a model Technology Transfer Symposium. Require that the NPS, in addition to the tasks of planning, execution, distribution of proceedings, and evaluations, obtain feedback from participants and attendees. Utilizing evaluation data generated during and immediately after the conduct of the symposium, combined with feedback obtained from participants and attendees, generate appropriate recommendations for modification to the planning and execution of follow on symposium on other technical subject areas to insure that a continuing program of improved effectiveness is realized.

C. TASKS TO BE ACCOMPLISHED

a. Designate Project Manager

b. Generate Plan to "Plan"

c. Identify and designate team to support Project Manager

d. Complete plan and initiate

e. Call for papers, establish date for submission

f. Select location

g. Issue Symposium announcement

h. Execute planning details; mail out data to all attendees

i. Conduct Symposium

j. Prepare proceedings, conduct initial evaluation

k. Mail out and receive post symposium questionnaires

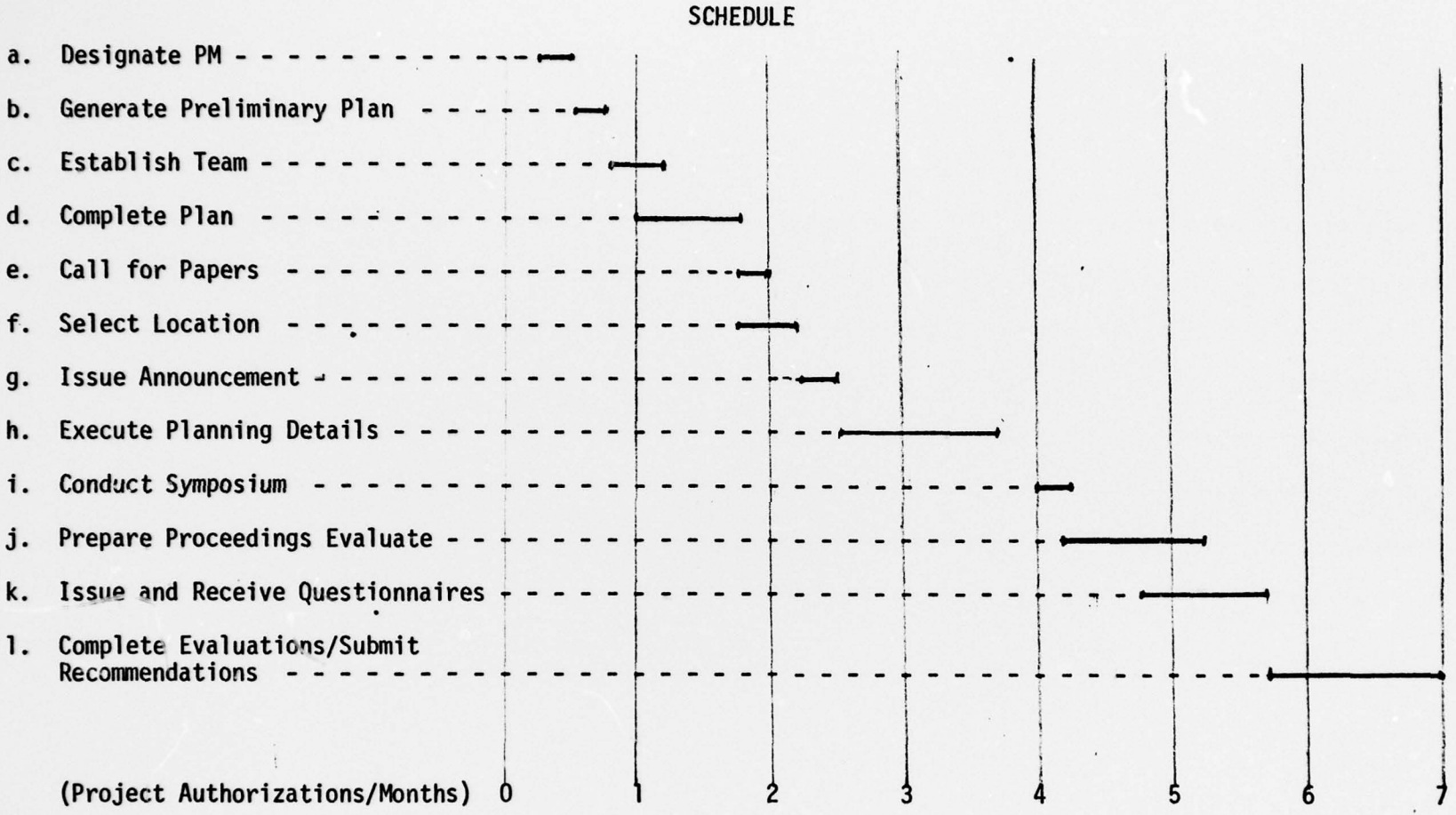
l. Complete final evaluation and submit recommendations for modifications to future symposiums

## COST ESTIMATE

ASSUMPTIONS

Symposium to be 3 days in length, with approximately 150 attendees out of 1000 mailed invitations.

| | |
|---|---|
| Labor (includes Project Manager and administrative support team plus secretary) | $60,000 |
| Literature (Brochures, questionnaires, proceedings, evaluation and final recommendations) | 1,000 |
| Travel and per diem (Project Manager, staff and guest speakers, honararia if necessary) | 9,000 |
| Facilities (3 days @ $10/day/attendee) | 4,500 |
| TOTAL | $74,500 |


SCHEDULE
a. Designate PM
b. Generate Preliminary Plan
c. Establish Team
d. Complete Plan
e. Call for Papers
f. Select Location
g. Issue Announcement
h. Execute Planning Details
i. Conduct Symposium
j. Prepare Proceedings Evaluate
k. Issue and Receive Questionnaires
l. Complete Evaluations/Submit Recommendations
(Project Authorizations/Months)
0
1
2
3
4
5
6
7



APPENDIX F

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